# Carrying cargo and affording decarbonised urban mobility - the integration of cargo bikes into urban load-carrying practices

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This thesis is dedicated to Brenda Pearce (1929-1976), my inspiring and determined mother, who taught me to believe in myself, that a healthy dose of stubbornness can be a virtue, and somehow saved the money to buy me my first bicycle.

## Abstract

The logistical requirements of moving goods and people within the urban environment are used to justify the use of motorised transport, within the domestic as well as the commercial realm. Serious environmental and social problems are linked to this reliance on carbon-intensive forms of mobility. Researchers and policy makers have turned their attention to alternatives to petroleum-based modes of urban travel and goods delivery. A new (old) cargo-capable technology, the cargo bike is resurgent in some, predominantly European, cities and has been the focus of European Union funded studies into its viability particularly within the urban commercial freight logistics chain.

This thesis makes an original contribution to current debate on promoting cycling by examining the ability of the cargo bike to meet urban load-carrying needs. This is achieved by extending consideration, from a social practice theoretical perspective to the freight function of domestic travel. This contribution is achieved in four main ways. Firstly, I extend study of cargo-cycling beyond the acclaimed cycling cities of Europe, to the US city of Portland, Oregon and to Christchurch, New Zealand. I focus attention on cities which have, by Anglophone but not European standards, relatively high cycling modal share, but until recent years only limited cargo bike availability. Secondly, by attending to domestic load-carrying, the relationship between transporting children, shopping, and other domestic goods, and achieving other daily mobility needs - the complexities of domestic logistical practices - are uncovered. Thirdly, I examine the nuanced relationship between cycling and driving in achieving cargo-capable mobility. Fourthly, by approaching the study of cargo-cycling from a practice-theoretical perspective, which challenges the dominance of policy formulations which rely on technical innovation and/or individual behaviour change, I focus on what people actually *do*, and examine the implications of a social practice theoretical approach.

By combining research techniques of empirical investigation with refinement of existing conceptual models, this study contests simplistic, dualistic representations of cycling versus driving. Instead, fluid nuanced relationships are identified, of bifurcation and hybridisation within and between load-carrying practices, impacted by the rhythms and (a)synchronicities of meeting load-carrying need. Complexity rather than the compartmentalisation of the practices which constitute daily life is

highlighted. Cargo cycles are found to be uniquely placed in offering a low-cost-in-use decarbonised mode of mobility, which can mesh with combinations of domestic and commercial practices. Access to the practice of cargo-cycling is found to be limited by availability and cost. This research, therefore, calls for innovation which facilitates access to the relatively environmentally and socially sustainable practice of cargo-cycling, as a low-cost-in-use cargo-capable mode of transport.

## Acknowledgements

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and working diligently to bring in the lion's share of our income, while I made my way through this project.

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## Abbreviations

| Abbreviation | Meaning |
|---|---|
| 3PLC | Third party logistics carriers |
| ABC | Attitude, behaviour, choice |
| $B_2B$ | Business to business |
| $B_2C$ | Business to customer |
| CBD | Central business district |
| CEP | Courier, express and parcel delivery services |
| DRT | Disaster relief trials |
| E-assist | Electric assistance |
| EU | European Union |
| GHG | Greenhouse gas |
| HAM | Amateur radio |
| IEA | International Energy Agency |
| IPCC | Intergovernmental Panel on Climate Change |
| JIT | Just in time |
| LDV | Light duty vehicle |
| MLP | Multi-level perspective |
| NET | Neighbourhood emergency team |
| $NO_x$ | Mono-nitrogen oxides |
| NZ | New Zealand |
| NZTA | New Zealand Transport Agency |
| OR | Oregon |
| SNM | Strategic niche management |
| STS | Science and technology studies |
| SUV | Sports utility vehicle |
| TfL | Transport for London |
| UCC | Urban consolidation centre |
| UK | United Kingdom |
| UMC | Urban micro-consolidation centres |
| US | United States |

# Chapter 1 Introduction

## 1.1 The scope of this study

This is a study of load-carrying by pedal cycle[1]. Unlike earlier work on Western urban utilitarian cycling, which has tended to highlight infrastructural provision or attitudes and behaviours, here the focus is on the achievement of load-carrying *practices* using the material affordance – the cargo bike[2]. Using interview, observational and secondary data sources, collected primarily in Christchurch, but also Palmerston North and Wellington, New Zealand, and in the United States in Portland, Oregon, I explore load-carrying practices, to discern the contribution cargo bikes, in their various forms (Figure 1-1), can make to decarbonising urban mobility. This exploration is achieved by investigating how cargo bikes are used for load-carrying, examining the integration of load-carrying into the routines of daily life, and the relationship between cycling and driving in the achievement of load-carrying activities.

**Figure 1-1 Cargo bikes at 2012 Disaster Relief Trials in Portland**
(source: author)

In this introductory chapter, I explain the development of my interest in load-carrying by pedal cycle, and the affordances offered by cargo cycles in achieving the freight function of travel. I describe the environmental and social context that arguably necessitates the decarbonisation of mobility, and

[1] The term pedal cycle is used to refer to two, three, and even four wheeled cycles designed to be propelled by the muscular energy of the rider, with or without the addition of electrical assistance (E-assist).

[2] In this research the terms cargo bikes, cargo cycles, and load-carrying bikes are used interchangeably to refer to a range of two, three, and occasionally four-wheeled human powered vehicles (sometimes with the addition of electrical assistance and/or weather protection) specifically designed and constructed to transport loads either in front or behind the rider. These bicycles, depending on their specific configuration are otherwise known as, for instance, freight bikes, freight tricycles, cycle-trucks, box bikes (bakfietsen), long johns, longtails, short johns, trade bikes, and carrier bikes.

provide a brief outline of the theoretical and analytical frameworks on which I draw.

## 1.2 **Research motivations**

Cycling is routinely presented as a healthy, sustainable, egalitarian, efficient and affordable mode of transport (see for instance Chapman, 2007; Kenworthy, 2007; Oosterhuis, 2014; Pucher & Buehler, 2008b; Vivanco, 2013b). However, despite the assumptions, implicit and explicit, in recent cycling related policy and research that cycling mode share can be increased by mechanisms which focus on 'infrastructural and social engineering' (Oosterhuis, 2014: 20), it is by no means clear that such mechanisms have been responsible for the reversal in the decline of cycling observed in some Western countries since the 1970s, or that they are easily spatially, temporally or culturally transferable. Probing these assumptions, Oosterhuis suggests that such policies might be better understood as a *response* to the increasing number of cyclists observed, most notably, in northern European, and to a lesser extent Anglophone countries, rather than as a *result* of those policies.

Such conundrums underpin my initial motivation to conduct this research, further stimulated by my own observations and encounters with load-carrying by pedal cycle. My early musings noted that while participation, particularly by women, in Anglophone countries remains stubbornly low, little attention has been given to the role of cycling technology in meeting the need to comfortably and efficiently accomplish regular and interwoven activities, such as shopping and child transportation, that require cargo capability. At the same time, observations of my own practices and those of friends and acquaintances suggested that significant load-carrying, such as supermarket shopping, is often the point at which default cyclists became default drivers. Later, I became aware of a *Scientific American* magazine article reporting that an 'emerging body of research suggests that a superior strategy to increase pedal pushing could be had by asking the perennial question: What do women want?' (Baker, 2009: para.1; see also Underwood, 2009). The article refers to work by Jan Garrard, Jennifer Dill, John Pucher and Susan Handy, all pointing to women being an "indicator species" for successful cycling. According to Baker (2009), Handy suggests that women need to think in terms of jumping on a bike, in the same way as they think of jumping into a car, to

carry out their daily utilitarian activities. Facilitating this change calls for consideration of not just *who* travels, but *when* and *how*, and in *what* circumstances (Brah, 1996; Sheller, 2008).

Second, the work of Bacchi resonated with my approach to problem solving. Bacchi (2009) advocates a technique of policy analysis which questions taken for granted assumptions, asking how it is possible for something to happen rather than why – analysing problem representations not problems. This approach was influential in supporting my moving this research beyond cycling, narrowly conceived as transport (Spinney, 2008b), to constantly 'turn the problem around' (Walker & Shove, 2007: 213), to think about load-carrying as the site of intersection of numerous daily practices (Shove, Pantzar, & Watson, 2012). In approaching this research in the context of transport system decarbonisation using a practice theoretical framework (Watson, 2012), I seek to both reframe the problem and the opportunities for intervention. As Watson puts it, the challenge is to:

> engender recruitment to contemporary practices of different modes of mobility, which can operate in the current socio-technical landscape. This perspective represents a fundamental shift from the individualistic focus of dominant approaches to understanding [and seeking to influence] travel behaviour (Watson, 2012: 493).

A third influence was the transport disadvantage literature, and its interface with the egalitarian potential of cycling, identified by a number of authors (Kenworthy, 2007; Pucher & Buehler, 2008b). If I hypothesised, cargo bikes could fulfil more load-carrying functions than conventional pedal cycles, they could present a practical, cargo-capable solution for not only those with sufficient disposable income to test their utility, but also those suffering the transport disadvantage of forced car ownership (Currie & Senbergs, 2007). Engaging with this literature, raised additional questions concerning the freight function of travel and the relationship between cycling and driving, so often expressed as polar opposites, ignoring the fact that most adult Western cyclists are also drivers (Koorey, 2007). In thinking about the affordability of cargo-cycling, my attention also turned to a small body of literature on effective speed (Tranter, 2004), an approach which calculates speed on the basis of internalising the full costs of a transport mode, including the time spent working to afford the fixed and flexible costs of that mode.

Fourth, developing a theme from my Master's research on community ownership of wind turbines (Pearce, 2008), I sought to reflect upon how, given the rarity of cargo bikes in New Zealand, early adopters of a technology become knowledgeable about that technology, and whether lack of *awareness* of alternatives, rather than a lack of *relevance*, could be limiting engagement with utilitarian technological affordance in the urban cycling literatures. Consequently, I found the social construction of technology (SCOT) approach (Bijker, 1995; Law, 2008; Rosen, 2002a; Valderrama & Jorgensen, 2008), in its stress on accounting for technology, culture *and* organisation as part of a socio-technology rather than as a discrete artefact, useful in my turning around of the problem.

While this is not a finite list of my early research stimuli, one more significant and ongoing influence deserves mention. Soon after commencing my doctoral research I moved to Christchurch, just in time to experience the devastating and long-term effects of the earthquake sequence commencing in February 2011. While this experience has had multiple effects for the people of Christchurch, for this research, its importance lies in emphasising to me the versatility and dependability of a pedal cycle, in a post-disaster, infrastructure-compromised environment.

In sum, although scholarship on urban utilitarian cycling has developed over the last 30 years, with the most notable exception of Cox and colleagues (see for instance Cox, 2012; Cox & Rzewnicki, 2015; Cox & van de Walle, 2007), consideration of pedal cycle design to meet utilitarian needs, has not been prioritised. There is growing interest, particularly in commercial cycle logistics in the European Union (EU), primarily focused on cargo bikes. In New Zealand, a report published by the New Zealand Transport Agency (NZTA) (Smith, Wilson, & Armstrong, 2011) on improving pedal cycle transportation to encourage its use on short trips, includes cargo bikes in its analysis. However, to this author's knowledge, there have been no specific studies of cargo-cycling for domestic purposes beyond the dominant cargo-cycling cities of Europe. In the light of all these points, it became apparent to me that my own initial musings and exploration of cargo-cycling could be valuable, in the context of the issues now briefly outlined.

## 1.3 Decarbonisation contexts

There is growing awareness of the global challenges that carbon emissions and climate change pose for society. This has led to increased levels of academic engagement with the sustainability of mobility and transportation systems (Schwanen, Banister, & Anable, 2011), and opportunities for a more sustainable transport sector. Trends and concerns regarding energy use in transportation can be observed in the interaction between the environmental issues of greenhouse gas (GHG) emissions, local air pollution, energy shortages such as peak oil and global increases in energy use (Potter, Berridge, Cook, & Langendahl, 2013), and observations regarding peak car (Newman & Kenworthy, 2011).

### 1.3.1 Climate change and the decarbonisation of transport

Despite climate change mitigation policies, global anthropogenic GHG emissions grew by an average of 2.2 percent or 1.0 gigatonne carbon dioxide equivalent ($GtCO_2eq$) per year between 2000 and 2010 (IPCC, 2014). This represents an increase in emissions over those recorded in the period 1970 to 2000 when on average GHG emissions rose at a rate of 1.3 percent, or 0.4 $GtCO_2eq$ per year (IPCC, 2014). $CO_2$ is the main anthropocentric GHG emission, producing 76 percent of the total in 2010. Transport accounted for 11 percent of this increase between 2000 and 2010, with population and economic growth driving the increase from fossil fuel combustion (IPCC, 2014). Around 94 percent of global transport makes use of petroleum products as fuel (IEA, 2011), with, as of 2014, worldwide transportation accounting for approximately 62 percent of petroleum consumption (Centre for Climate and Energy Solutions, 2014).

The IPCC (2014) suggests, a business as usual approach to economic and population growth will drive further increases in GHG emissions. This so called baseline scenario, projects global mean surface temperature increases of between 3.7° Celsius (C) and 4.8°C by 2100, based upon projected $CO_2eq$ atmospheric concentration levels. Mitigation scenarios are, however, usually based upon keeping 2100 temperature increases to 2°C or 450 parts per million (ppm) $CO_2eq$, relative to pre-industrial levels. It is widely recognised, that due to a lack of ready substitutes for the high energy density and transportability of petroleum derived fuels, the transport sector is harder to

decarbonise than stationary energy use (Kenworthy, 2007; Schwanen et al., 2011). The transport sector is responsible for 23 percent of total energy-related carbon dioxide ($CO_2$) emissions (IPCC, 2013), with commercial transport contributing 20 percent of total transport emissions in urban areas (Gruber, Ehrler, & Lenz, 2013). Urban freight is more polluting than long distance freight movement, due to the older average age of the fleet, short trips, and regular stopping. In addition to GHG emissions and noise pollution, freight transport contributes one third of total transport related nitrogen oxide ($NO_x$), and half of transport related particulate matter (Dablanc, 2011a). Direct transport related GHG emissions have more than doubled since 1970, with approximately 80 percent of this increase emanating from road vehicles (Figure 1-2). Further, direct vehicle emissions are not the only source of impact on the global climate, as the production and distribution of fuel from petroleum, are also contributory factors.

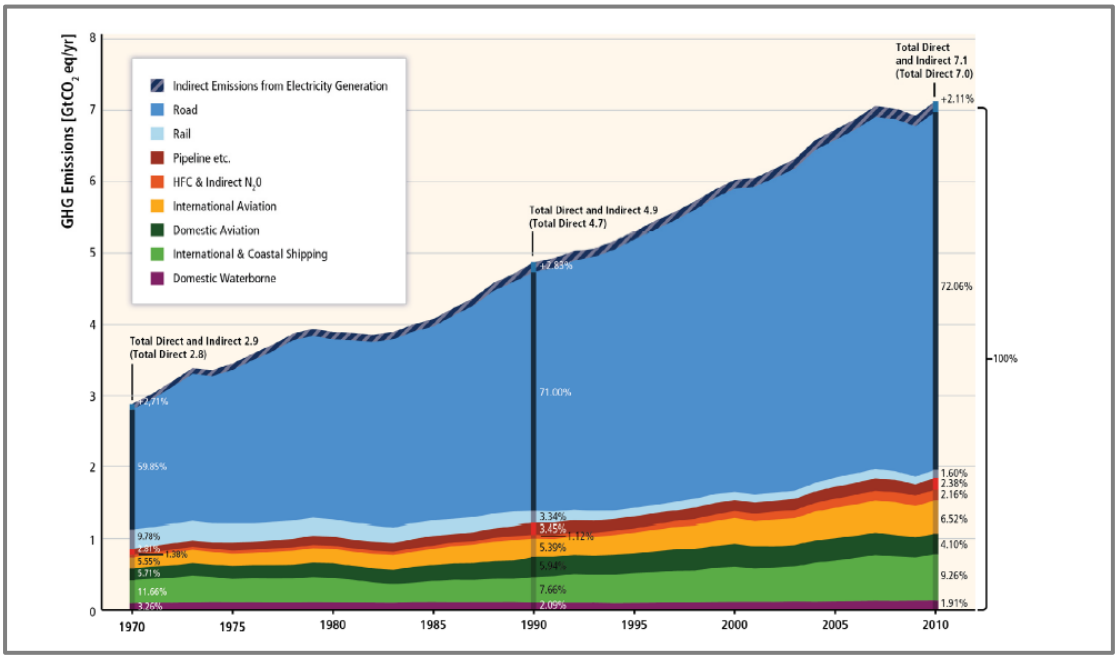



**Figure 1-2 Direct global GHG emissions by transport mode between 1970 and 2010**
(source: IPCC (2013: 7))

Eighty percent of total global motorised passenger kilometres are made by only approximately ten percent of the global population (IPCC, 2013), predominantly living in OECD countries. According to Chapman (2007), the $CO_2$ emissions from a private car are composed of 76 percent fuel usage, nine percent vehicle manufacture, and 15 percent fuel supply system losses.

### 1.3.2 Peak oil

Like climate change, peak oil – the point at which global oil production peaks and thereafter declines – is expected to generate significant global challenges for the commercial and domestic transport sectors. Estimates of the time frame for peaking vary, with many assuming it has already occurred, and the most optimistic suggesting 2030. Whenever it occurs, peak oil is expected to reduce individual mobility, increase transport disadvantage, and disrupt freight movements (Aftabuzzaman & Mazloumi, 2011)

Proposed strategies which seek to respond to a post peak oil era include modal shift, technological developments in vehicles and fuel sources, and integration of transport and land use planning (Aftabuzzaman & Mazloumi, 2011). However, the effectiveness of strategies which continue to assume that cars can remain the core facilitator of personal travel are questioned (Hillman, 2012), given that responses to peak oil and other resource constraints are a long term issue, which 'cannot be disconnected from the need to avoid catastrophic climate change … irrespective of short term volatility in the price of hydrocarbons' (North, 2010: 585). The IPCC have already pointed to a 'strong slowing of light-duty vehicle (LDV)[3] travel growth per capita' (IPCC, 2013: 4) in some OECD cities, a phenomenon that has become known as peak car.

### 1.3.3 Peak car

It is claimed that transitions such as peak oil and peak car 'can only be recognised in retrospect' (Goodwin & Van Dender, 2013: 250). Peak car hypothesises, that 'per capita car use is close to its maximum level, and *may* stabilise or turn down' (Lyons & Goodwin, 2014: 1). The phenomenon has only been recently acknowledged, despite evidence which suggests that peak car occurred in the early 2000s (Kuhnimhof, Zumkeller, & Chlond, 2013), the Brookings Institution in 2009 being the first to recognise decline in car use in OECD cities. Analysis of International Transport Forum statistics for the 2000s from Germany, Australia, France, UK, USA, and Japan show only minor signs of growth, and indications of decline in car use (Goodwin, 2012). Essentially, there are three views concerning currents trends in car ownership in OECD countries: 1) that growth in car ownership has been temporarily

3 In New Zealand LDVs usually have a gross vehicle mass (GVM) of less than 3500kg.

interrupted due to an economic downturn, 2) that car ownership has peaked and is unlikely to show more growth (Metz, 2013), and 3) that car ownership has moved beyond a turning point and is thus in sustained decline (Goodwin, 2012). However, some governments, including those of the UK and New Zealand, see this decline as a temporary response to worsening economic conditions (Lyons & Goodwin, 2014), even though these changes clearly precede the economic downturn, and do not correspond with traditional forecasts (Goodwin, 2012). As Goodwin points out, specific policy approaches do not necessarily result from the peak car phenomenon, but it does 'widen the set of feasible policy outcomes, especially those intended to encourage less car-dependent lifestyles for reasons of health, economic efficiency, or environmental improvement' (p. 15). One strategy to respond to peak car, peak oil, and climate change, is to increase the number of urban trips made by pedal cycle (Burke & Bonham, 2010).

## 1.4 The pedal cycle as a socially and environmentally equitable solution for shorter trips

Three groups, women, children. and those on low incomes are argued to be most affected by the social inequity resulting from car-centred transportation systems (Godefrooij, Pardo, & Sagaris, 2009). Modal shift away from LDV use is recognised to be one component of the decarbonisation of transport processes (IPCC, 2013), which may also be a challenge to that inequity.

Cycling is argued to be 'the ultimate 'zero carbon' means of personal transportation (Chapman, 2007: 363). Kenworthy (2007) goes further in suggesting that cycling is one of the 'most egalitarian and sustainable modes of urban transport' (p. 50). The pedal cycle is argued to be a decarbonising solution for shorter trips as well as providing an:

> affordable way to get around the city … a convenient alternative to driving, cycling reduces traffic congestion, promotes a cleaner environment, creates healthier communities, and improves [neighbourhood]… quality of life' (Emanuel, 2012 as cited in Vivanco, 2013b: xviii).

Thus, there are apparently a number of reasons to encourage cycling, many of these reasons being encapsulated in the research of Pucher and Buehler (2008b), who enthuse that cycling:

> causes virtually no noise or air pollution and consumes far less non-renewable resources than any motorised transport mode. The only energy cycling requires is provided directly by the traveller, and the very use of that energy offers valuable cardiovascular exercise. Cycling requires only a small fraction of the space needed for the use and parking of cars. Moreover, cycling is economical, costing far less than both the private car and public transport, both in direct user costs and public infrastructure costs. Because it is affordable by virtually everyone, cycling is among the most equitable of all transport modes. In short, it is hard to beat cycling when it comes to environmental, social and economic sustainability (p. 496).

Taking these assertions at face value, and given statistics such as the inverse relationship found between obesity and active modes (Figure 1-3), it is hard to understand why cycling is not more common in all Western countries.

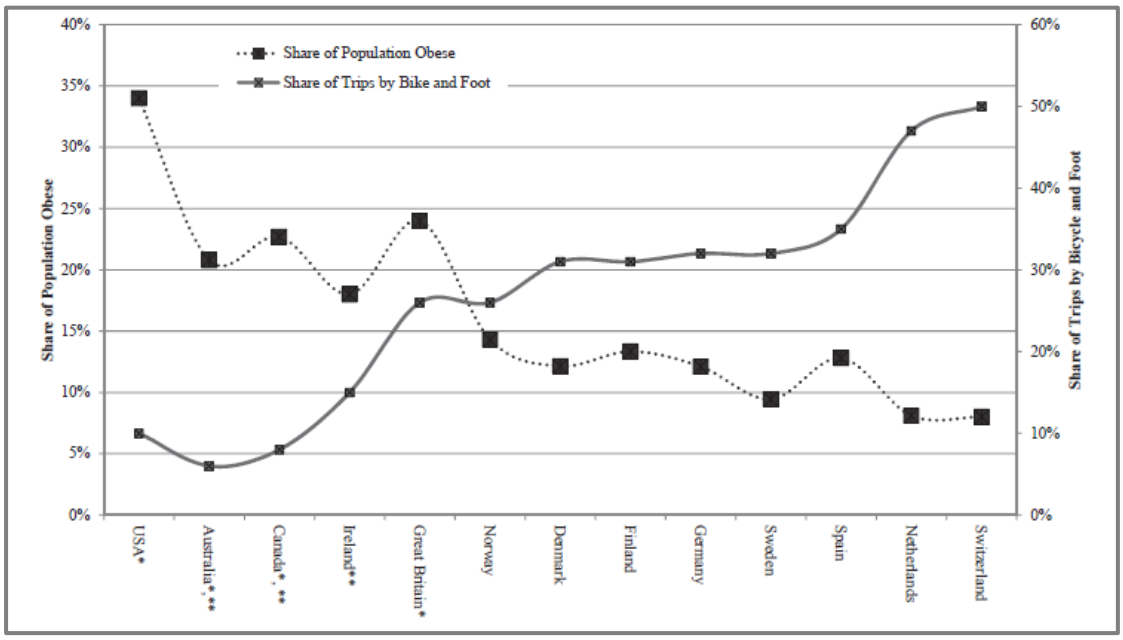



**Figure 1-3 Relationship of obesity to cycling and walking**
(source: adapted from Pucher, Buehler, Bassett, & Dannenberg (2010))

Cycling participation rates are, however, highly divergent, with Anglophone countries having the lowest rates (Figure 1-4). However, these low cycling rates are not representative of all Western countries, consequently, many scholars having investigated the inconsistencies between countries. Pucher and colleagues (Pucher & Buehler, 2005, 2006, 2007, 2008a, 2008b, 2010, 2012b; Pucher, Buehler, & Seinen, 2011; Pucher & Dijkstra, 2003; Pucher, Dill, & Handy, 2010; Pucher, Garrard, & Greaves, 2011; Pucher & Renne, 2003; Pucher, Thorwaldson, Buehler, & Klein, 2010), have been particularly prolific in analysing cycling trends in Western countries, reflecting on, and

seeking inspiration from the reversal of decline, and later renaissance in amongst other countries, Denmark, the Netherlands and Germany.

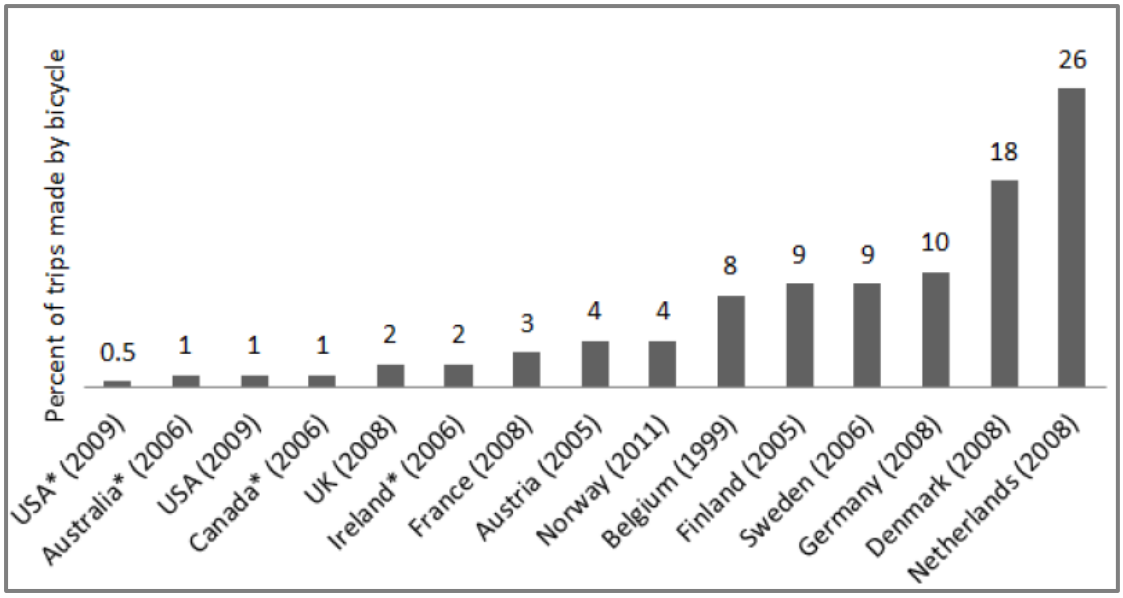



**Figure 1-4 Percentage of total trips by pedal cycle in Europe, North America, and Australia 1999-2008**
(source: Pucher & Buehler (2012b: 10))

A striking difference can be observed between cycling participation in northern mainland European countries, where cycle-based urban mobility[4] is seen to be a socially, age and gender diverse activity, and Anglophone countries where it is not. For instance, women are much more likely to cycle in the Netherlands (31 percent of trips vs. 26 percent for men), Denmark (17 percent of trips vs. 15 percent), Germany, Finland, and Sweden, than in Anglophone countries (Figure 1-5). In Germany, women make more cycle trips per week than men (2.54 vs. 2.31), and cycling rates since 1976 have increased more rapidly among women than men (Garrard, 2003). Thus, while data from mainland Europe shows that cycling rates vary little across gender and age strata (Pucher & Buehler, 2008b; Pucher & Dijkstra, 2003), in many Anglophone countries not only are cycle-based urban mobility rates low, but there are also significant gender differences (Garrard, Rose, & Lo, 2008; Pucher & Dijkstra, 2003).

[4] Mobility being defined as the 'intertwined physical, technological, social, and experiential dimensions of human movement' (Vivanco, 2013b: 8)

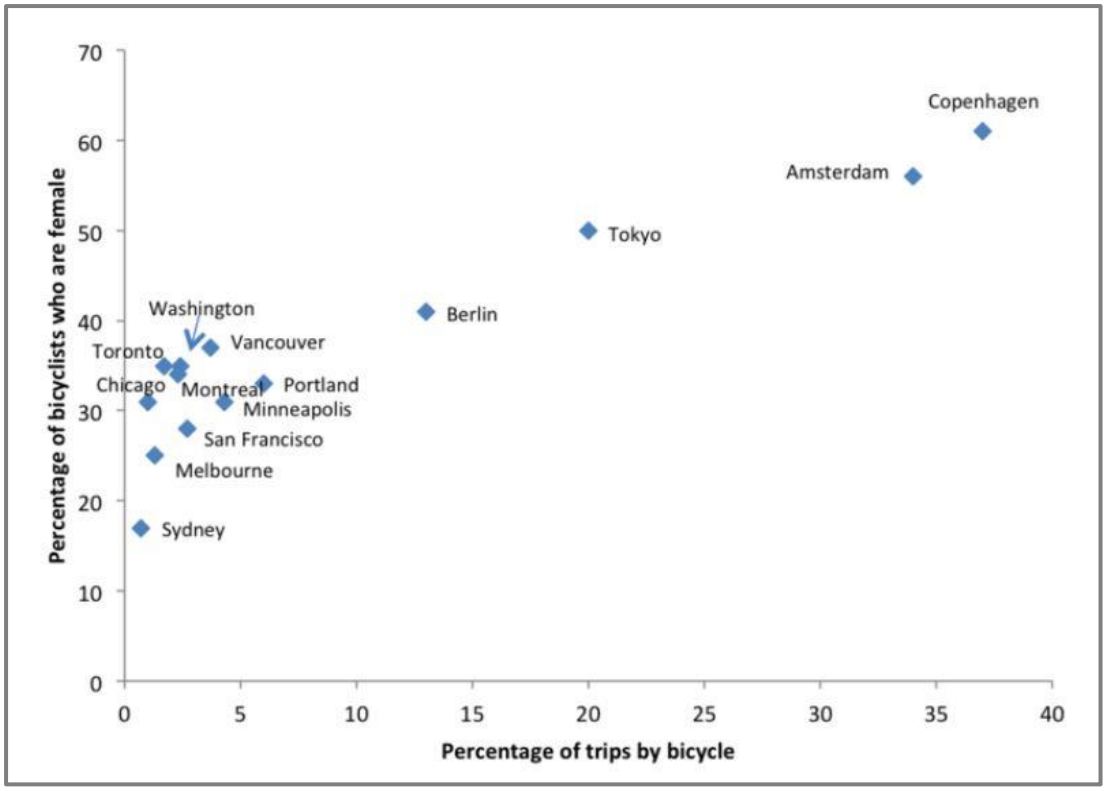



**Figure 1-5 Pedal cycle mode share of trips and percentage of women cyclists in large cities**
(source: Garrard (2011))

Such data. potentially represents an opportunity to increase the diversity of utilitarian cycling in Anglophone countries (Winters, Friesen, Koehoorn, & Teschke, 2007), with the overall unevenness of participation in cycling generating a policy and academic focus on how cycling can be encouraged.

### 1.4.1 Encouraging cycling

In drawing lessons from cities like Copenhagen and Amsterdam, academic researchers and planners have concentrated on the role of public policy in encouraging cycling. For instance Pucher, Dill and Handy (2010) state that attainment of substantial increases in cycling rates, requires integrated packages of complementary interventions, including 'infrastructure provision and pro-bicycle programmes, supportive land use planning, and restrictions on car use' (p. S106). However, interventions have not necessarily proved successful, leading to debate about the causes of policy failure (Aldred & Jungnickel, 2014). Evidence reviews are not uniform in their conclusions (Ogilvie, Egan, Hamilton, & Petticrew, 2004; Pucher, Dill, et al., 2010; Yang, Sahlqvist, McMinn, Griffin, & Ogilvie, 2010), at least in part due to differences of opinion on what actually constitutes evidence (Aldred & Jungnickel, 2014;

Oosterhuis, 2014). Further, as Dickinson, Kingham, Copsey, & Pearlman Hougie (2003) observe, there is a tendency to tackle symptoms such as cycling facilities, rather than underlying problems, such as complex trip-chaining requirements.

Dickinson et al. (2003), find the need to make trips for shopping and transporting children limiting, particularly for women's, cycling opportunities. Similarly, Lovejoy and Handy (2012) regard the load-carrying limitations of conventional pedal cycle design, coupled with the daily reality of needing to transport cargo or passengers, as a barrier to cycling. In Ireland, Mullan (2012) finds the practical considerations of dropping-off and collecting children from school, to be one of the biggest disincentives to cycling for transportation among recreational cyclists. Further, researchers report issues such as luggage capacity, equipment, children, organising, and trip chaining as *individual* minor barriers to cycling (see for instance Taylor, Kingham, & Koorey, 2009), when it is possible that taken *collectively* these issues pose a more significant issue than they are currently understood to be.

Despite these identified restrictions, and the recent proliferation of cycle designs focussed on the varying practices of cycle-based urban mobility (Pucher & Buehler, 2012b), academics and planners have largely ignored the role of equipment in supporting urban cycling (Lovejoy & Handy, 2012). Hitherto, where cycling equipment has been a focus, it has tended to be on bike sharing programmes (Shaheen, Guzman, & Zhang, 2012), such as the high profile schemes in London and Paris, or the potential disincentive of mandatory helmet wearing (Kidder, 2005; Walker, 2007). Lovejoy and Handy (2012: 75), even point to an informal survey of cycling experts in Europe, which suggests that 'innovations in equipment would do little to increase the already high levels of bicycling there'. However, it is not clear whether equipment diversity has had any impact on achieving those high levels of participation, or whether increasing that diversity in locations with lower mode share, might have a positive impact on cycling participation, particularly by women.

### 1.4.2 Enter the cargo bike

Overall, incentivising cycling is argued to require effective competition with other transport modes, based upon matching not only the time, cost, comfort, and enjoyment possibilities of other modes, but also meeting gender-based logistical convenience criteria (Lovejoy & Handy, 2012). In Copenhagen where 60 percent of cyclists are women (Garrard et al., 2012), cargo bikes are already common, with 18 percent of motorists surveyed by the City of Copenhagen (2013: 20) finding cargo bikes to be important to them, in shifting from driving to cycling for shorter trips.

Despite their current association with cities including Amsterdam and Copenhagen, cargo bikes are not a new phenomenon. Even before the invention of the safety pedal cycle in the mid-1880s (Herlihy, 2004) carrier tricycles were used to deliver goods and mail, and to carry the tools of artisans and trades-people (Basterfield, 2011). Having declined in use from the 1950s, as patterns of consumption and retailing changed, cargo bikes re-emerged in Europe in the 1970s, as part of a counter-cultural response to social and environmental degradation (Cox & Rzewnicki, 2015). Recently, having become known as the sports utility vehicles (SUV) of cycling (City of Copenhagen, n.d.-b), cargo bikes are being used for personal and business logistics[5], by men and women, young and old. In Copenhagen more than a quarter of all families with two or more children have a cargo bike, with 17 percent of cargo bike owning households, replacing a car with a cargo bike (City of Copenhagen, 2013). Recent EU funded projects CycleLogistics (2011-2014), and CycleLogistics Ahead (2014-2017) have concentrated on expanding the commercial and municipal use of cargo bikes (www.cyclelogistics.eu/).

References to cargo cycles as the SUV, station wagon, or minivan of cycling, for their ability to carry significant loads, are now also being found in newspapers such as the Wall Street Journal, cycling magazines and bumpers stickers across Europe, the US and Australasia (see Fagan, 2010; Kirby, 2012; Walljasper, 2011 and Figure 1-6 for examples). Portrayals of cargo cycle use and design in the media, via social networks and through advertising material, routinely point to 'changing the public perception of what trips really require

[5] Here the term logistics is used to include the transport of goods and people from A to B.

the use of a personal automobile' (McKeegan, 2013: 41), the suitability of cargo bikes for carrying loads (Lennon, 2011), and the rationality of their use for moving freight in the urban environment in a carbon-constrained world - the 'SUV for intelligent living' (http://www.ecf.com/press_release/its-boom-time-for-cargo-bikes/). Activists point to cargo cycle attributes, such as their versatility, ability to combat congestion in urban environments, and relative cheapness compared to their motorised counterparts.


**Figure 1-6 Cargo bike features from Bicycle Times Magazine, the Wall Street Journal, and cargo bike bumper sticker**
(Source: http://bicycletimesmag.com/?s=cargo+bike+suv, http://online.wsj.com/news/articles/SB10001424127887324328204578572011343756542 and https://www.kickstarter.com/projects/1887563980/less-car-more-go-the-cargo-bike-documentary)

The use of electrically assisted (E-assist) cargo cycles is also attracting attention, as a means of making urban transport more sustainable, partly

because of their ability to mitigate some limitations of cycling (Gruber, Kihm, & Lenz, 2014; Lenz & Riehle, 2013), particularly for commercial purposes or in hilly terrain, such as rider fatigue, range and payload restrictions (Transport for London, 2009).

The popularity of cargo cycles in cities like Copenhagen and Amsterdam, which are noted for the diversity of their cycling cultures, renders the current lack of academic and policy attention to the potential of cargo-cycling surprising, showing a clear gap in the literature. As McMeekin and Southerton (2012) point out, when considering transitions to more sustainable forms of consumption:

> … there is more at stake than the simple adoption of more eco-efficient technologies … the absorption of technologies into practices must be amongst the most significant forces in changes to practices as performances and entities. This reinforces how important it is to look beyond the purchase of new products into how these products are actually used and embedded within existing nexuses of practices (p. 358).

In investigating how cargo bikes are actually used and embedded within the activities of daily life, I utilise a practice theoretical approach.

## 1.5 **Practicing cycling**

A range of theoretical and methodological approaches have been used to investigate cycling, making use of quantitative and qualitative methods, including for instance ethnographic enquiry (Pooley, Tight, et al., 2011), surveys (Dablanc, Giuliano, Holliday, & OBrien, 2014), phenomenological research (Spinney, 2008b), and discourse analysis (Ravenscroft, 2004).

This research demands a theoretical and methodological focus capable of analysing both what people do with their pedal cycles and the importance of the material thing that is the pedal cycle, to that doing. My search for a theoretical approach which allowed me to centre the doing of cycling, and to turn the problem around to view it from angles not easily reconciled with behavioural or structural approaches, led me eventually to a practice theoretical approach[6]. Practice theories, in accounting for 'the absorption of

[6] This research is mindful of the distinction in British English between practice (noun) - the application, implementation of an idea or method, or the repetition of an activity - and practise (verb) - to perform an activity repeatedly. Consequently, practising constitutes practices, and practices affect practising (Birtchnell, 2012).

technologies into practices … how these products are actually used and embedded' (McMeekin & Southerton, 2012: 358), broadly match my way of thinking about problems, and as an evolving approach, allow some room for methodological experimentation.

Practice theories are argued to have salience across the humanities and social sciences. The contemporary application of practice theories across the domains of transportation, energy use, sustainability, consumption, equity, and social policy, in moves towards a decarbonised transport system, can be observed in the disciplines of geography, environmental sciences, sociology, consumption studies, and science and technology studies (see for example Everts & Jackson, 2009; Everts, Lahr, & Watson, 2011; Hargreaves, Haxeltine, Longhurst, & Seyfang, 2011; Hargreaves, Longhurst, & Seyfang, 2013; Shove et al., 2012; Shove & Walker, 2010, 2013; Spaargaren, 2011; Watson, 2012). Practice theories have only recently been applied to the sustainability of travel (Birtchnell, 2012; Heisserer, 2013). If, as is argued by Furness (2010), the sustainable transportation credentials of pedal cycle mobility have been largely thought of in individualistic terms, rather than as 'a set of social, political, economic relationships' (Vivanco, 2013a: 34) then practice theories may offer a fruitful way of integrating those relationships into analysis and policy. The emphasis on the material in the recent analytical simplification of practice theories (Røpke, 2009), known as social practice theory (SPT), is one area of convergence between geographers and practice theory relevant to this study. In SPT, materials are located:

> firmly within the dynamics of practices … by appreciating individual artefacts and arrangements of nonhuman entities as emergent from the flow of practices, and … the shaping of subsequent performances of practices by those artefacts and arrangements, we gain fresh purchase on the role of materials … as part of the flow of action through which social relations are both reproduced and iteratively transformed (Everts et al., 2011: 330).

Chapter 3 presents the fundamental concerns and affordances of practice theories concentrating on SPT. Here, in the interests of being succinct, I offer a brief introduction to this 'way of thinking' (Shove, 2003a: 20), based upon three generic 'building block' elements of practice - materials, competence and meaning - argued to allow identification of the dynamic emergence of patterns and connections, and description of transformation, diffusion and circulation

of practices. Shove et al. (2012) describe the 'bare bones' of accounting for the dynamics of social practice as follows:

> Practices-as-performances involve the active integration of elements (materials, meanings, competences). Practices-as-entities are constituted through such integrations. Practices change when new elements are introduced or when existing elements are combined in new ways. Elements of meaning, materiality and competence are themselves outcomes of practice. Although they are generated and changed through moments of enactment, elements – being part of several practices at once – have somewhat independent lives of their own. If practices are to survive they need to capture and retain practitioners willing and able to do this integrating and therefore willing and able to keep them alive. Relations between practices take different forms – some collaborative, some competitive, some weak, some strong. Whatever form they take, such relations matter for the trajectories of the elements and individual practices of which composite bundles and complexes of practices are made. Finally the connections involved, between elements and practices, and between one practice and another, are maintained and reproduced through intersecting circuits of reproduction that have dynamic qualities of their own (pp. 119-120).

This account of practices underpins the doctoral research presented in this thesis, which is formulated to answer the research question now posed.

## 1.6 Analytical framework

In this research, the aim is to contribute to scholarly and societal debate by developing understanding of the use of cargo cycles for personal logistics, and their ability to meet the complex transportation needs, of people living and working in the Western urban environment.

In order for cargo cycles to become a serious decarbonised option for transportation, both the advantages, challenges and obstacles to their use need to be explored. The main research question is, therefore: **what contribution can cargo bikes make to decarbonised urban mobility in Western countries?**

Awareness of specific elements of cycling hardware and components, and the skills, competence and norms associated with their use, are prerequisites for them being incorporated in daily mobility practices. Answering the research question from a practice theory-based perspective, addresses three objectives:

a. To examine how load-carrying is achieved by pedal cycle, with a specific focus on cargo bikes.

b. To identify how cargo-cycling is incorporated into everyday activities, how it coexists and competes with other practices and its potential contribution to more sustainable patterns of mobility.
c. To critically assess the implications of adopting an SPT framework to understand cargo-cycling as urban load-carrying mobility.

## 1.7 **Practical and theoretical justification**

By seeking to ascertain the contribution cargo bikes can make to decarbonised urban mobility, this research responds to and develops cycling research in relation to theory, policy, practice, technology and equity. In developing cycling research in these directions, I emphasise the following points:

1. Taking into account the experiences of those already involved in non-automobile dependent mobility strategies (Cox, 2008: 144), is significant for learning about how daily activities can be achieved without reliance on automobiles, in an automobile dominated environment, but in a carbon constrained world.
2. While social theories do not lead directly to policy prescriptions, they do permit understanding of policy problematisations, and the types of policy interventions, that in different jurisdictions are regarded as possible, plausible or worthwhile' (Shove et al., 2012: 139). This research is consistent with calls from a number of researchers to explore new approaches to research, that approach the problems of 'behaviour change' (Shove, 2010b) from a broader perspective than is the norm in policy prescriptions. Upham et al. (2009: 6), on the basis of their selective review of theory and practice in relation to UK attitudes to climate change, state that 'exploring the implications of the practices approach and of other approaches focusing on social, economic, political and other factors external to the individual is a clear theme for further research in terms of anticipating and influencing public responses to particular types of environmental change'. Likewise, Shove (2010b) sees the need to 'reconceptualise behaviour change *within* policy' by designing interventions at a scale which can provoke transitions in practice. In Shove's view, this reconceptualisation is not about plugging-in a practice-based approach into 'behavioural' initiatives, but instead 'radically extending

the meaning of intervention and the conceptualisation of social action' (p. 3).

3. Lovejoy and Handy (2012: 75) ask 'How can bicycle equipment help to increase utilitarian bicycling?'. They conclude that the availability of equipment designed to meet the needs of people using bikes for utilitarian purposes 'makes utilitarian bicycling more feasible and more desirable for more people on more occasions' (p. 75). They point to the interplay between consumers and manufacturers, that can facilitate the availability of cycling equipment designed to support utilitarian cycling. For instance, lack of knowledge of availability, or how to use equipment, precludes its use, irrespective of its design merits.
4. Currie and Delbosc (2009) suggest that research should address the vulnerabilities associated with low income car ownership, 'to establish ways to address emerging issues … vulnerabilities [that] might well act to affect the mobility and accessibility choices being made' (p. 10). This research, engages with how the use of cycles can potentially counter both what is seen, on the one hand, as the disadvantage of not owning (although potentially having access to) a vehicle, and what on the other hand, is regarded as a disadvantage of vehicle ownership for people living on low incomes.

## 1.8 Thesis structure

This introductory chapter has set out the background to the enquiry and development of the research question. I have identified the problem dimensions and outlined the theoretical and conceptual foundations of the research, and then canvased the practical and theoretical justification for the research. The chapter concludes with an overview of the rest of the thesis (Figure 1-7), which is divided into three parts.

**Part A** – Accounting for cycling - comprises three chapters (Chapters 2 - 4) which together seek to contextualise the study within the relevant literature, and outline the research strategy.

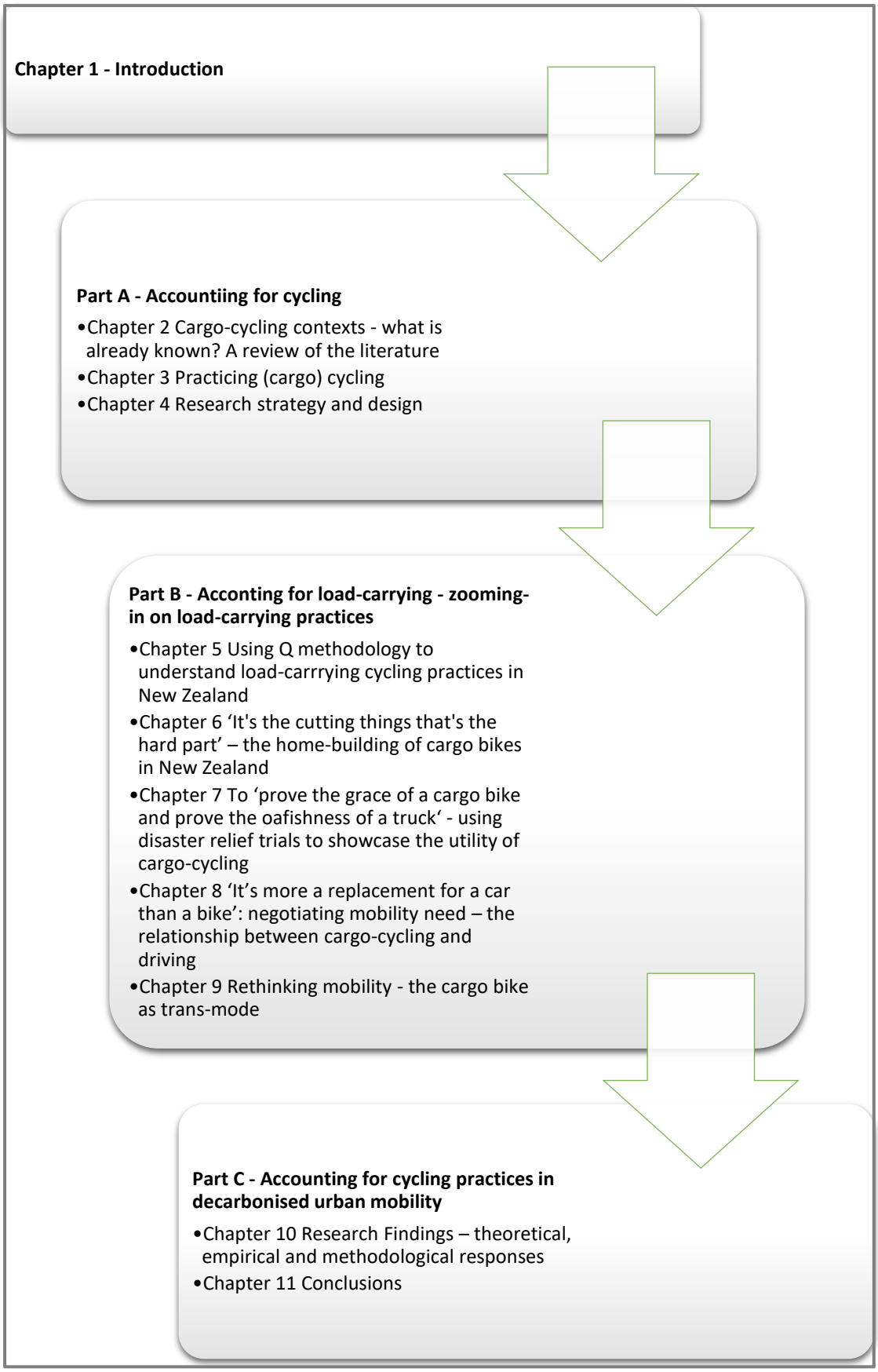



**Figure 1-7 Thesis structure**

Chapter 2 develops the themes outlined in this introduction, situating cargo cycling within the broader literatures on the environmental and social aspects of sustainability, before focusing specifically on load-carrying by pedal cycle, as expressed in cargo-cycling.

Chapter 3 expands upon the development of practice theories, to outline the application of SPT to this thesis. This chapter then reviews how SPT has thus far been operationalised in cycling research

Chapter 4 serves two purposes: 1) to outline the research approach, design, and methods in broad-brush terms, a focus enhanced by a more specific attention to methods found in Part B, in each of the empirical chapters, and 2) to introduce the visual schema, used to represent the application of practice theory to this research.

**Part B** – Accounting for load-carrying - zooms in on five aspects of load-carrying practices, in five empirical chapters (Chapters 5 - 9).

Chapter 5 presents an exploratory photograph–based Q methodological (QM)[7] study of load-carrying practices in New Zealand, focusing on the doing of the practice of load-carrying by pedal cycle. In QM, the collective viewpoints of participants are represented in factors which maximise the representation of the variance found within the study - in how practitioners do load-carrying by pedal cycle. On the basis of by person factor analysis, I identify four main variants of load-carrying practice. Here, in seeking to operationalise SPT using QM, the factors are understood to represent the distribution of cycling load-carrying practice, as statistically significant variants or sub-practices, performed by the practitioners who loaded on a particular factor.

Chapter 6 zooms in on the home-building of cargo bikes in Christchurch, where until recently commercially produced cargo bikes have been rare. The

[7] QM, originally developed by William Stephenson in the 1930s, is associated with a set of theoretical and methodological concepts designed to reveal the viewpoints of a group of participants in a holistic and qualitatively detailed manner (Watts & Stenner, 2012). Here, in common with many social and psychological investigations, QM is used as a technical method within another theoretical framework, which has the potential to be useful in researching shared meanings (Harvey et al., 2012).

catalysts for such projects and the distribution of competence, materials, and meanings in home-building practices are explored.

Chapter 7 zooms in on cargo-cycling in Portland focusing on a specific cargo biking event, designed to alert the public and municipal authorities to the affordances of cargo-cycling, using a post-earthquake disaster scenario. This chapter blends practice theory with scholarship on indirect activism, to examine how celebratory events seek to aid recruitment to practices, whilst in this case, seeking to engender systemic change in disaster preparedness.

Chapter 8 splits focus between Christchurch and Portland, to examine social justice in the context of cargo-cycling. Scholarship on transport disadvantage and forced car ownership is used to interrogate how cargo-cycling and driving practices coexist, and how cargo cycles are used to negotiate the need to drive for load-carrying purposes.

Chapter 9 again refocuses the gaze, to examine the relationship between cycling and driving as load-carrying practices. Developing themes from the previous empirical and theoretical chapters, this chapter forms a 'think-piece' which interrogates claims that pedal cycles cannot substitute for cars. An argument is advanced examining the bifurcation of cycling practices based upon the incorporation of cargo bikes, to speculate upon the transmodality of the cargo bike as a hybrid form, which in adding a "boot" to the pedal cycle makes it closer to a car.

Finally, **Part C** – Accounting for cargo-cycling in decarbonised urban mobility – draws together the previous chapters in two chapters (Chapters 10 and 11), to draw-out the themes relevant to the research question and the objectives of the research.

Chapter 10, in examining the themes derived from the previous chapters, sets out to understand the ways in which cargo bikes can be incorporated into everyday practices, to facilitate and support change towards lower carbon mobility. The themes derived from the research account for the recruitment and persistence of cargo-cycling, its integration with other practices,

relationships with driving, and the implications of adopting a social practice theoretical approach to conduct this research.

Chapter 11 draws this research to a conclusion, by summarising the research findings and assessing the contribution this study has made to scholarship on the decarbonisation of urban mobility.

# Part A – Accounting for cycling

**Accounting for cycling - zooming-out to the bigger picture** - consists of three chapters framing the extant literature on cycling, introducing practice theory, and examining the contribution that practice theory has made to research on cycling, and outlining the research approach developed in subsequent chapters. Part A, therefore, not only reviews what we already know about load-carrying by pedal cycle, as a decarbonised, and potentially socially equitable form of mobility, but also frames how this research pursues and accounts for new knowledge of urban load-carrying by cargo bike. Part A thus lays out the theoretical, methodological, and contextual underpinnings of the empirical chapters located within Part B of this thesis.

**Chapter 2** develops some of the themes introduced in the Introduction as found in existing scholarship. Cycling is situated within the wider global challenge of achieving decarbonisation of transportation. The equity implications of making transportation more environmentally sustainable are then raised, before directing focus to urban mobility, where cycling is argued to present a realistic alternative for achieving short utilitarian trips. Having revealed the limitations imposed on load-carrying by the use of conventional pedal cycle configurations, attention then turns to the low level of consideration given thus far, in academic and policy domains, to the use of cargo bikes to achieve load-carrying in urban environments. To situate this discussion, the range of designs and cargo capabilities of cargo cycles are described. A review of the existing policy and academic focus on cargo bikes reveals, in Western countries, a primary focus on commercial logistics, primarily in the EU. The minimal focus identified thus far on domestic use of cargo bikes, and their implications for equitable access to decarbonised urban transport reinforces the gap in the literature which this thesis seeks to partially fill. This lack of focus on cargo bikes is apparent in both New Zealand and the US, the two sites of data collection for this thesis.

**Chapter 3** deals specifically with theories of practice, both reviewing the development of the theory and discussing how it has been operationalised in the broader field of cycling research. Practice theories are framed as the building blocks of social life, with the doings of everyday life always being the

performance of a practice, rather than something simply individual and reducible to choice. Chapter 3 introduces the conceptual foundations of practice theories, positioning them between behavioural and structural explanations of phenomena, before explicating the variant of practice theory – SPT – underlying this research. The core building blocks of an SPT-based understanding of practices are laid out, before explaining how SPT is operationalised in this research. Existing applications of practice theoretical accounts of cycling, sometimes in parallel with other perspectives, are introduced as the discussion progresses.

Warde (2014) describes theories of practice as a 'lens to magnify aspects of common social processes which generate observable patterns' (p. 279). Building on this idea of magnification, several recent contributions (Kuijer, 2014; Nicolini, 2012; Spurling & McMeekin, 2014) have made use of a zooming metaphor in their exploration of practices. The remainder of this thesis employs, and further develops a 'zooming' metaphor to illustrate the development of the relationship between theory and the empirical components of this research, a schema developed based upon zooming-in and -out on the observable patterns of practices. Consequently, **Chapter 4** has two purposes, to present the overall research design, and to set out how practices are conceptualised within the zooming metaphor in this thesis. In presenting the research design, and in maintaining the zoomed out perspective of Part A, the focus is deliberately broad. The overall logic of the research methodology is developed, whilst the specific methods employed for each empirical chapter are included within those chapters. The schema used to visually represent the zooming-in and -out on the performances of practices dealt with in this thesis, and the relationship within and between practice-entities – the inter- and intra-practice relationships – is then introduced.

# Chapter 2 Cargo-cycling contexts – what is already known? A review of the literature

## 2.1 Introduction

This literature review engages with what Vivanco (2013b) calls 'a new (old) thing' (p. xvii) - the bicycle, and specifically the cargo bike - a material object which facilitates, in association with the requisite competences and societal meanings, the practice of cargo-cycling – transporting freight or people for commercial or personal logistical purposes, on a cycle specifically designed for that purpose. A limited volume of literature makes specific reference to the cargo bike, providing 'bits and pieces which can be used as building blocks of a more integrated perspective' (Geels, 2004: 20). To provide an entrée to this literature I take the global challenge of sustainable mobility, as expressed in the sustainable transport literature, as the entry point to this review. I present a broad brush appraisal of issues of transport sustainability and equity, concentrating on decarbonisation via modal shift, although elements of substitution and technological change are also integrated. I then direct attention to the role of cycling in promoting more sustainable and equitable systems of mobility. I distinguish the cargo cycle from other forms of pedal cycle and provide a brief indicative taxonomy of cargo cycles. The practice of cargo-cycling is then reviewed from the perspective of the two literatures which have, thus far, engaged with this technology, and its integration in the social fabric of society – logistics and social equity. Finally, making a connection to New Zealand, a NZTA report *'I'll just take the car' improving bicycle transportation to encourage its use on short trips* (Smith et al., 2011), which engages in some consideration of the use of the cargo cycles for short trips, is briefly reviewed.

## 2.2 Global challenges at the sustainable transport/mobility interface

By its very nature climate change produces injustice (Bickerstaff, Walker, & Bulkeley, 2013; Conway, Fatisson, Eickemeyer, Cheng, & Peters, 2012): both its causes and impacts are spatially, temporally, and socially uneven (Agyeman, 2013; Banister, 1994; Boschmann & Kwan, 2008; Colleoni, 2011; Dobson, 2003; Eames & Hunt, 2013; Miller, 2009; Seyfang & Paavola, 2008;

Walker & Eames, 2008). Even in Western countries, which are better placed than developing countries to mitigate the effects of human-induced climate change, the poorest people will be disproportionately affected (Cahill, 2010).

The transportation of people and goods has increased exponentially in the last 50 years, the energy input into the systems and material objects of transportation being directly linked to the carbon emitted (Banister, Schwanen, & Anable, 2012, p. 201). As outlined in section 1.3.1 there are serious environmental consequences resulting from those climate changing emissions (Cahill, 2010). Increasing public interest has been observed in decarbonisation and sustainability (Bickerstaff et al., 2013). Technological fixes, alongside behavioural modification, are the mainstay of environmentally sustainable mobility policy initiatives (Barr & Prillwitz, 2014; Spurling, McMeekin, Shove, Southerton, & Welch, 2013). While the role of technology is important in societal functioning, of themselves material objects 'have no power, they do nothing' (Geels, 2004:19). In sustainable just societies, as in unsustainable unjust societies, or points in between, to fulfil functions, material objects, or technological fixes, need to be associated with human agency and societal structures (Geels, 2004).

The social, equity and environmental issues involved in mitigating climate change, through the decarbonisation of transport systems, require ongoing political, policy, and academic engagement (Bickerstaff et al., 2013). Over the last 15 years, considerable academic effort has gone into researching uneven access to mobility services (see for example Cass, Shove, & Urry, 2005; Currie & Delbosc, 2010; Dodson & Sipe, 2008; Johnson, 2007; Kenyon, Lyons, & Rafferty, 2002; Lucas & Currie, 2012; Miciukiewicz & Vigar, 2013). For instance, in the early 2000s, Lucas and colleagues (2001) drew attention to the increases in distance travelled associated with rising car ownership, 'forcing' people to travel to engage in basic activities. This resulted in low-income people spending a disproportionately high percentage of their income on travel. At the same time, at a local level, concerns have been articulated about a number of environmental and social stresses, such as the impact of community severance and high volume traffic flows, on low income communities (Cahill, 2010), including emissions from transport, air pollution,

and use of land for transportation purposes (Lucas, Grosvenor, & Simpson, 2001).

The term sustainable transportation arose from the concept of sustainable development, and in broad terms 'aims to provide accessibility for all to help meet the basic daily mobility needs consistent with human and ecosystem health' (IPCC, 2013: 12). Vivanco (2013b) argues that use of the term 'transportation' is conceptually limiting, as it directs attention to the means of conveyance, treating people as things to be conveyed rather than as actively included (or excluded) in social and cultural processes. By contrast, mobility is understood to incorporate three interdependent dimensions – movements, networks, and motility (Urry, 2007; Vivanco, 2013b) - expressed in corporeal travel, the physical movement of objects, media images of travel, virtual travel, and interpersonal communicative travel, all 'producing social life organised across distance' (Urry, 2008: 14). To be sustainable, forms of mobility necessarily must offer combinations of climate change mitigation potential. This can be achieved by reducing the need to travel (substitution), reducing trip lengths, supporting modal shift, and increasing transport system efficiency (technological change) (Banister, 2008). Maximising the potential to walk and cycle for most trips so that people do not need to use a car is, therefore, a core component of sustainable mobility.

Although decarbonisation of transport is broadly accepted as necessary, it is often assumed, at least in Western countries that motorised transportation is the only serious means of transporting loads and distributing goods and services, despite there being ample evidence to the contrary from Asia, Africa and South America (Cox, 2010b; Petty, 2001). Policy prescriptions, whether 'hard' or 'soft' have thus far lacked effectiveness, with demand elasticities for commuting remaining low (Banister et al., 2012; Oosterhuis, 2014; Walker, 2014a). Soft behavioural measures are shown to be of little lasting influence, and then over only small spatial and temporal scales (Banister et al., 2012; Cairns et al., 2008). Facilitating more environmentally sustainable modes requires sensitivity to the ways people live and how particular practices develop (Hitchings, 2011; Hitchings & Day, 2011; Shove, 2010a), and prolonged changes in the structural relationships affecting car use (Goodwin & Van Dender, 2013). As Jones et al. (2012) point out, land-use planning

tends to normalise and privilege car use in urban areas, in such a way that conditions for both the practices of cycling and walking are rendered 'inhospitable' (p. 1421). Habits and routines are thus held in place by existing infrastructures, their related technologies, and long standing conventions so that they become deeply ingrained (Chappells, Medd, & Shove, 2011; Shove, 2003a).

When discussed, technologies are often described in technologically determinist, linear, evolutionary narratives (Cox & van de Walle, 2007) which do not explore cultural, political and social interconnections. This can be seen in both accounts of the development of the pedal cycle over time 'wedded to an unsupportable framework of inevitable technological progress' (Cox, 2012: 1), and accounts of the decline of cycling in Western countries and its replacement with what Urry (2004) calls the system of automobility. Urry (2004) defines automobility as the 'self-organizing, self-generating, non-linear world-wide system of cars, car-drivers, roads, petroleum supplies, and many novel objects, technologies and signs' (p. 27). Automobility is argued to be one of the main socio-technical systems in the organisation of modernity (Böhm, Jones, Land, & Paterson, 2006).

Despite problems, which include 'environmental unsustainability; economic wastefulness; death and injury; and social dislocations, inequities, and exclusions' (Conley & McLaren, 2009: 2), automobility dominates the other modes of transportation with which it coexists in modern mobility practices (Cox & van de Walle, 2007; Oldenziel & de la Bruhèze, 2011, 2012). Automobility makes car driving both possible, and arguably necessary (Conley & McLaren, 2009; Paterson, 2007). The benefits of automobile ownership and use accrue mostly to individuals in terms of auto-mobility (autonomous mobility), if they can pay the private costs of vehicle purchase, fuel, maintenance, insurance and other on-road costs. However, vehicle users do not pay the full costs of the wider system of automobility such as infrastructure, pollution, urban sprawl and traffic collisions. Further, the illusary application of the term automobility to car driving implies a very limited defntion of autonomous mobility (Ker & Tranter, 2003). In car driving, the driver may be by themself, in terms of being alone whilst travelling, but at the same time totally reliant on the wider systems of technology,

infrastructure, and policy to facilitate that being alone (Böhm et al, 2006; Conley & McLaren, 2009). As Soron (2009) makes clear, challenging the coercive system of compulsory automobility 'will require much more than efforts to transform the everyday behaviours, beliefs, identities, desires and emotions of individual consumers' (p. 181), demanding a revision of the policy assumptions used to address climate change mitigation (Barr & Prillwitz, 2014).

## 2.3 **Transport and equity**

The economic and environmental impacts of transport have traditionally been afforded primacy over the social and distributional effects (Geurs, Boon, & Van Wee, 2009; Markovich & Lucas, 2011). Further, distinction between economic and social effects 'is often pragmatic' (Geurs et al., 2009: 70), as economic issues of travel time, surplus income, employment, and earnings all have social implications. As Banister (1994) shows, transport decision-making always results in 'winners and losers' (p. 1), but ambiguity remains about what actually constitutes a social, equity, or distributional effect of transport (Markovich & Lucas, 2011). Distributional effects vary spatially and temporally across societal groups, and have the potential to be cumulative (Geurs et al., 2009; Markovich & Lucas, 2011).

If people who are 'socially and spatially excluded [the losers] are those who are … unable to participate in the social groups, worlds and networks membership of which would, for them, constitute 'normality'' (Shove, 2002: 1), they will not be able to achieve the mobility and co-presence needed for social participation. As transport geographers have shown, social exclusion has a number of components which include, but are not exclusive to income, all relating to participation in civil society (Currie et al., 2009, 2010; Hine & Mitchell, 2003; Preston & Rajé, 2007; Rajé, 2007). Social exclusion is often seen as a measure of an objectively definable condition that people experience or suffer from (Shove, 2002). For instance, Kenyon, Lyons and Rafferty (2002) explain lack of access to adequate mobility, opportunity, social networks, goods, and services, as correlated to social exclusion, both in terms of cause and consequence, questioning whether increased physical mobility of itself can overcome mobility related social exclusion. Policy interventions are argued to be necessary to remove barriers to inclusion because overcoming

exclusion is 'beyond the control of excluded persons' (Lucas, 2010 as cited in Markovich & Lucas, 2011).

Transport disadvantage[8] and its association with social exclusion has been widely researched in the UK, and issues of transport equity are addressed in US policy (Lucas & Currie, 2012), often under an environmental justice framework (Agyeman, 2013). Studies of social exclusion have shown it to be a very context- and person-specific phenomenon (Mackett, Achuthan, & Titheridge, 2008; Preston & Rajé, 2007). Thus, not all transport disadvantaged people are socially excluded, and social exclusion does not necessarily result in transport disadvantage (Markovich & Lucas, 2011). As this type of analysis has spread, the focus has widened to what might be termed *environmental inequalities*: 'how matters of justice, inequality, and fairness intersect with those of environment and sustainability' (Walker & Eames, 2008: 664). Walker and Eames argue that this terminology is helpful because of its inclusion of a number of conceptions of inequality including social exclusion. They are also deliberately provocative, in using inequality as a description of difference *between* groups of people, rather than contextualising inequality as necessarily an injustice. This positioning is at variance with normative transport policy prescriptions of equity and fairness (as made by the Social Exclusion Unit, 2003), based upon minimum levels of opportunity to participate, irrespective of demographic factors such as income, gender, age, ethnicity or disability (Markovich & Lucas, 2011). According to Lucas (2006), individual travel behaviour (or consumption) can provide clear examples of environmental inequality, where under-consumption by the marginalised can lead to social exclusion, with:

> general 'over-consumption' of the rest if the population disproportionately disadvantages already deprived and vulnerable sectors of the population. Broadly speaking, it is this over-consumption that creates 'transport exclusion', but the policies that have been introduced to address the problem entirely fail to address this aspect of the problem (n.p.).

Lucas and Currie (2012) argue that transport disadvantage is likely to receive increased international policy recognition 'in the context of global recession,

[8] Transport disadvantage can be defined as difficulties in accessing public or private transport and/or difficulties in maintaining private transport due to its financial cost (Rosier & McDonald, 2011).

associated local job losses and reduced disposable incomes, as well as the ageing structure of most Western societies' (p. 151).

Contemporary research has suggested that transport disadvantage results from lack of access to a car (being carless) and/or being on a low income (Dodson & Sipe, 2008; Social Exclusion Unit, 2003). Increasingly car dependence is also being recognised as a disadvantage, where being 'forced' into high levels of car ownership, due to lack of alternative transport options can itself be the source of disadvantage (Currie & Senbergs, 2007). Sprawling car-oriented cities are seen to intensify transport disadvantage, transport poverty being induced when, transport costs, and particularly car ownership and use costs, are 'forced' onto households (Aftabuzzaman & Mazloumi, 2011; Dodson & Sipe, 2007, 2008). Home location, and the accessibility of activities and services, potentially mediate the relationship between transport and disadvantage (Currie & Delbosc, 2009; Dodson & Sipe, 2008): the distinction between being carless or car-free (Cahill, 2010). For instance, transport disadvantage has been found, in studies of fringe urban Australia, to relate more to people experiencing forced car ownership rather than no car ownership, meaning that transport disadvantage does not necessarily equate to overall lack of access to transport (Currie et al., 2009).

Some cities, which embody car-oriented city characteristics have successfully promoted cycling using techniques similar to those used adopted in cities like Copenhagen, Amsterdam, Muenster, and Groningen (Buehler & Pucher, 2012). In the US, even the car-centric cities of Portland and Minneapolis have increased cycling participation by more than 500 percent in the period 1990-2010 (Buehler & Pucher, 2012).

## 2.4 **The role of cycling in urban mobility**

In contrast to 'erroneous assumption of historical obsolescence' of the pedal cycle, when confronted with the automobile in linear progress narratives (Cox, 2013: 120), the relationship between cycling and driving and automobility is argued to be inherently dynamic in terms of competition and symbiosis (Shove et al., 2012; Watson, 2013). In a wide ranging framing of sustainable mobility, Banister (2005) suggests seven core objectives for sustainable mobility: reducing the need to travel, reducing absolute levels of urban automobile use

and road based freight movements, promoting energy efficient modes, reducing vehicle emissions and noise, encouraging the efficient use of existing vehicles, improving pedestrian and other road user safety, and increasing the attractiveness of the city to its users. As Cox (2010a) makes clear, increasing cycle use can make a significant contribution to all except the first objective, as witnessed by recent academic and policy focus on cycling as a form of urban mobility (Cox, 2010a; Godefrooij et al., 2009; Tight et al., 2011).

This growing literature examines the experience of urban cycling from a number of perspectives. These include the impact of cultural meanings on cycling practices (Aldred & Jungnickel, 2013, 2014; Pelzer, 2010), cycling demographics (Garrard et al., 2012; Pucher & Buehler, 2008b; Smith, 2005; Steinbach, Green, Datta, & Edwards, 2011; Wupperman & Grassick, 2009) the role of advocacy, activism and cycle politics (Aldred, 2012; Furness, 2005, 2010; Hurst, 2009; Mapes, 2009; Wray, 2008), identity and sensory mediation with the urban environment (Aldred, 2013; Jones, 2005; Jungnickel & Aldred, 2014; Skinner & Rosen, 2007; Spinney, 2008a; Wood, 2010), cycling discourses and decision making (Bonham & Cox, 2010; Green, Steinbach, & Datta, 2012; Jones et al., 2012; Pooley, Horton, et al., 2011) cycling and the social construction of technology (Bijker, 1995; Cox & van de Walle, 2007; Rosen, 2002a) E-assist pedal cycles (Cox, 2012; McHardy, 2013), and bike messenger culture (Fincham, 2006, 2007, 2008; Kidder, 2005, 2009). Analysis has also been extended to the commercial sphere, to review the role of bike messengers in the logistics chain (Maes & Vanelslander, 2012).

Policies that promote cycle-based urban mobility – cycling as an everyday mode of transport to a destination (Lovejoy & Handy, 2012) or series of destinations (trip-chaining) (O'Fallon & Sullivan, 2009) – have tended to focus on infrastructure (such as bike lanes) and/or behaviour change programmes, which seek to encourage pedal cycle use. For example, Pucher and Buehler (2008b), drawing on lessons from cities in Denmark, the Netherlands and Germany, list seven policy initiatives or innovations which contribute to cycling participation: extensive systems of separate cycling facilities, intersection modifications and priority traffic signals, traffic calming, bike parking, coordination with public transport, traffic education and training, and traffic laws. Despite the revival of cycling in the Netherlands and

Denmark, the system of automobility is argued to be as well established as in other Western countries with much lower rates of cycling, such as the UK. Even in the Netherlands, with its heralded cycling infrastructure and high rates of cycling, many people still do not cycle for journeys that would be achievable by this mode (Heinen, Van Wee, & Maat, 2010). Indeed, the Dutch Government expected the construction of cycle paths to increase cycling to a higher rate than has actually been achieved (de la Bruhèze, 2000). The revival of Western cycling is very uneven (Shove et al., 2012); de la Bruhèze (2000), with Oosterhuis (2014) claiming that these local differences are rooted in the historical development of spatial planning, traffic policies, and the local image and culture of cycling. To support his case, de la Bruhèze compares Dutch cities, where the development of car infrastructure 'was not at the expense of cyclists' (p. 4), and cycling continued to be seen as rational, cheap and clean, with cities such as Manchester (UK), Basle (Switzerland) and Antwerp (Belgium) where infrastructure was built to incentivise car use, and cycling was characterised as 'old fashioned, shabby and as a traffic nuisance' (p. 4).

As first commented upon in section 1.4.1, in these reviews of cycling exemplars, little if any attention has been given to the role of equipment. This is despite references in the literature to the perceived 'difficulty of carrying loads while cycling' (Heinen et al., 2010: 59), and despite there being increasing diversity in pedal cycle design to cater to the needs of people undertaking cycle-based urban mobility, in terms of age, gender, location, skill and purpose (Pucher & Buehler, 2012b). Indeed, as Godefrooij, Pardo and Sagaris (2009) point out:

> for some people cost is a barrier to bike use, as is the lack of (suitable) bikes. Design of both bicycles and the right accessories, especially for carrying groceries, children, books and other cargo, is particularly important for children and women (p. 26).

This point is echoed by Mullan's (2012) Irish findings, concerning a reluctance on the part of recreational cyclists to cycle for cycle-based urban mobility, partly based upon the practical constraints of transporting children on conventional pedal cycles.

Even Banister's (2005) first objective of sustainable mobility – reducing the need to travel – has linkages to cycling, one aspect of reduced need to travel being the rapid growth in online shopping, which has significantly increased

home delivery volumes of small shipments (Suksri, Raicu, & Yue, 2012), some of which are delivered by pedal cycle. In twelve European countries the CycleLogistics project focussed on reducing the 'energy used in urban freight transport by replacing unnecessary motorised vehicles with cargo bikes for intra-urban delivery and goods transport in Europe' (CycleLogistics, n.d.). The subsequent CycleLogistics Ahead project seeks to move more businesses and municipal authorities from motor vehicle to cargo cycle use (Cox & Rzewnicki, 2015).

Meanwhile, the Danish municipal authority, the City of Copenhagen (2009, 2010, 2011a, 2011b, 2013, 2015, n.d.-a, n.d.-b), and blogger Mikael Colville-Andersen (2008) have brought attention to the use of cargo bikes for day-to-day transportation. Cargo bikes are also a common sight in Amsterdam and other cities in the Netherlands (Ministerie van Verkeer en Waterstaaf & Fietsberaad (Expertise Centre for Cycling Policy), 2009), and increasingly are found in other European cities.

## 2.5 **Cargo-cycling**

Any form of pedal cycle can be equipped with load-carrying devices, such as racks and panniers or baskets, and a range of child seats are also available. The addition of a one or two wheel demountable trailer increases the cargo capability of a pedal cycle, with trailers being available designed specifically to carry children. A tag-along is an alternative form of child-carrying trailer, designed to allow a child to sit on a saddle and pedal (Cox, 2008). Variations in cycle design impact the efficiency and power output of cycling. The cargo bike adds an additional variable – the carrying capacity or freight function of the pedal cycle design itself (Figure 2-1). As Cox (2012) shows, an indicative plotting of these variables is useful for comparative purposes, emphasising the multiplicity of solutions cycling can offer.

Cargo cycles are intentionally designed and built to carry heavier or more awkward loads than can easily (or safely) be accommodated by more conventional pedal cycles - in other words, they maximise carrying capacity. The incorporation of E-assist further impacts carrying capacity, both in terms of increased payload and the steepness of the terrain that can successfully be

traversed on these heavier cycles. Lovejoy and Handy (2012) describe the typical attributes of a long-wheelbase cargo bike as utilitarian:

> Two- or three-wheeled, with a special rack, tray, open or enclosed box, platform or basket for carrying large or heavy cargo, positioned either low behind the front wheel or between parallel wheels in the front or rear. Often with stronger wheel and frame construction and lower gear ratios to accommodate heavy loads. May incorporate electric assistance (p. 81).

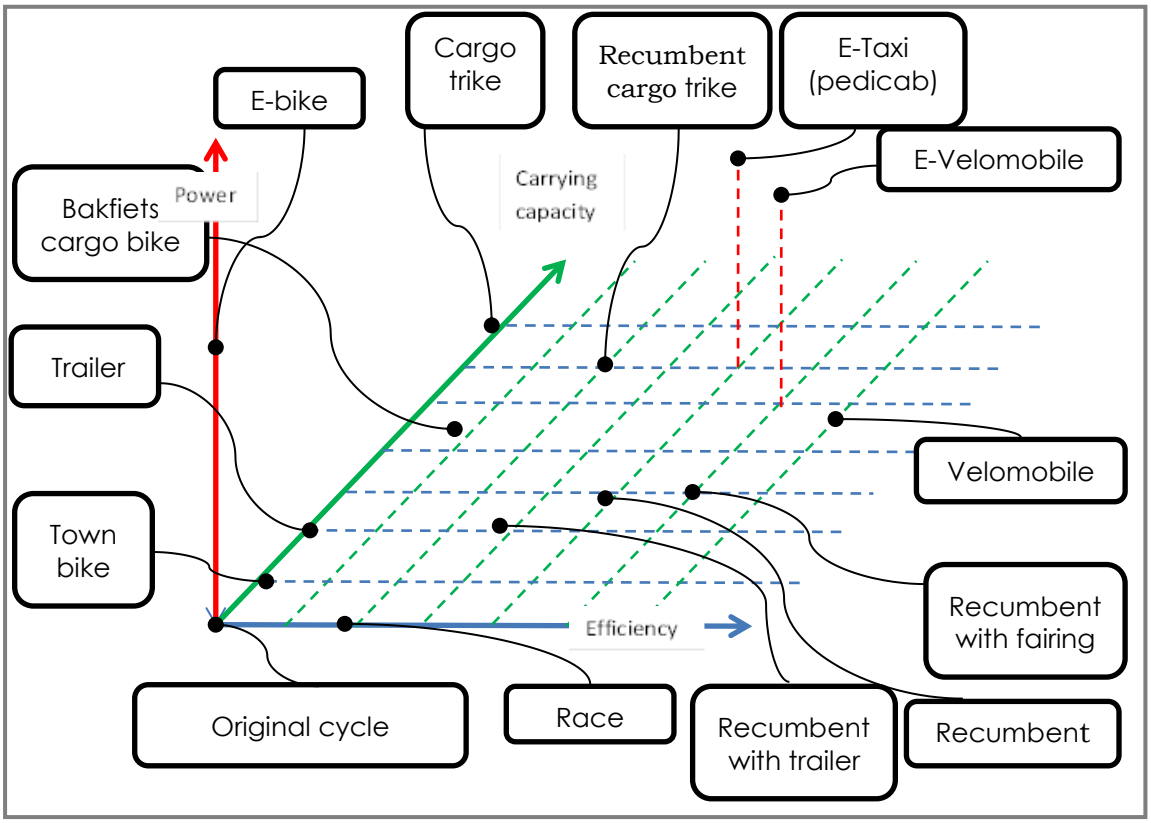



**Figure 2-1 Relative relationship between power, efficiency and carrying capacity of cycle designs**
(source: adapted from Cox (2012: n.p.) Note: Velomobiles are enclosed pedal cycles offering increased rider protection and aerodynamic efficiency, which can incorporate E-assist technology (Cox & van de Walle, 2007).

Although these cycles have been the subject of renewed attention and innovation since the late 1970s when they re-emerged as a vehicle of personal transport, which has latterly spread transnationally (Cox & Rzewnicki, 2015), recognition should be given to 'a similar plethora of designs … already in existence in the late 19th century' (Cox, 2012: n.p.). As early as 1881, the British postal service had a contracted supplier of carrier tricycles, and these sorts of cycles were quickly taken up by tradespeople for goods delivery (Petty, 2001), where they represented 'clean modern technology' (Norcliffe, 2011: 240). Cargo cycle designs originated as work pedal cycles, but more recently

have been redesigned for domestic utilitarian transportation purposes, blending comfortable riding positions with style and utility (Cox, 2008). The term cargo cycle can be applied to a number of cycle designs or styles (Table 1), variously known for instance as short johns, long johns, and longtails. Pedicabs designed to carry non-pedalling passengers also fall into the broad category of cargo cycles. Distinctions are frequently drawn within these categories and the terminology is not necessarily internationally consistent. Lovejoy and Handy's description for instance clearly encompasses long johns but does include other forms of cargo bike such as the longtail and short john.

**Table 1 Cargo cycle categorisation**
(adapted from http://velo-city.org/cargo-cycles/index.html and manufacturer websites)

| Category | Variation | Description | Use |
|---|---|---|---|
| **Short john** | Cycle truck  | Original work bike design, often known as butcher's or baker's bikes. Capacity ~25kg* | Historically used to deliver grocery items |
| | Front loader  | Designed to carry the majority of the load over the front fork and capable of carrying heavier loads than the cycle truck. | |
| **Long john** |   | Originally designed over 70 years ago. A number of modern versions are now in production. Capacity ~ 100kg* | Utilitarian cargo carrier, modern versions are favoured by cycle couriers due to being narrower and lighter than a bakfiets |

| | | | |
|---|---|---|---|
| | Bakfiets (2 wheel)<br>  | A bakfiets (box bike) is one of the modern forms of long john now being manufactured by a number of companies. Capacity ~60kg* | Can carrying several children and freight |
| **Longtail** |  | Can be created by attaching an extension frame to an existing bike. Capacity 180kg** | Can carry goods and people. |
| |  | Purpose designed complete bikes are built to a similar design but with a greater load capacity of 200kg+** | |
| **Tadpole trike** (Traditionally also known as Bakfiets) |  | 3 wheel cycle with 2 parallel wheels at front. Rider balance and kickstand not required. Capacity 100kg* | Can carry goods and people. Also used by businesses to distribute freight or for mobile businesses |
| **Delta trike** |  <br>  | 3 wheel upright or recumbent cycle with parallel wheels at rear. Rider balance and kickstand not required. Capacity~ 200kg** | More suited to carrying freight than passengers, unless in pedicab form. |

| | | | |
|---|---|---|---|
| **Pedicab** |   | Usually a 3 wheel cycle with parallel wheels at rear. A recent Western development of the rickshaw usually designed to carry two or possibly three adult passengers, incorporating upright and semi-recumbent riding styles. | Carriage of non-pedalling passengers. |
| **Quadri-cycle** |  | One to four plus seat 4 wheel pedal cycle in a variety of configurations | Carriage of pedalling and non-pedalling passengers |

*freight and/or passenger load only
** payload including rider

The long john, originating in Denmark in the 1920s, was the first front 'extended' cargo cycle (Petty, 2001) designed for stability and ease of loading. Until the recent growth in popularity of cargo cycles in Western countries, these cargo cycles were most commonly been found in Denmark, northern Germany, and The Netherlands, where they are known as bakfiets (box bikes) (Basterfield, 2011). The two-wheeled rear extended cargo cycle is a much more recent cargo cycle design, emanating from the US and the UK. While this design looks and rides more like a conventional cycle, it is argued by some that the requirement of some designs to distribute the load on either side of the rear wheel limits its utility (Basterfield, 2011). However, choosing an appropriate cargo-capable cycle depends on a number of factors including load capacity, riding style, benefits, drawbacks and cost (Figure 2-2). In this research, I concentrate on cargo cycles that have the capacity to carry a load of at least 50kg.

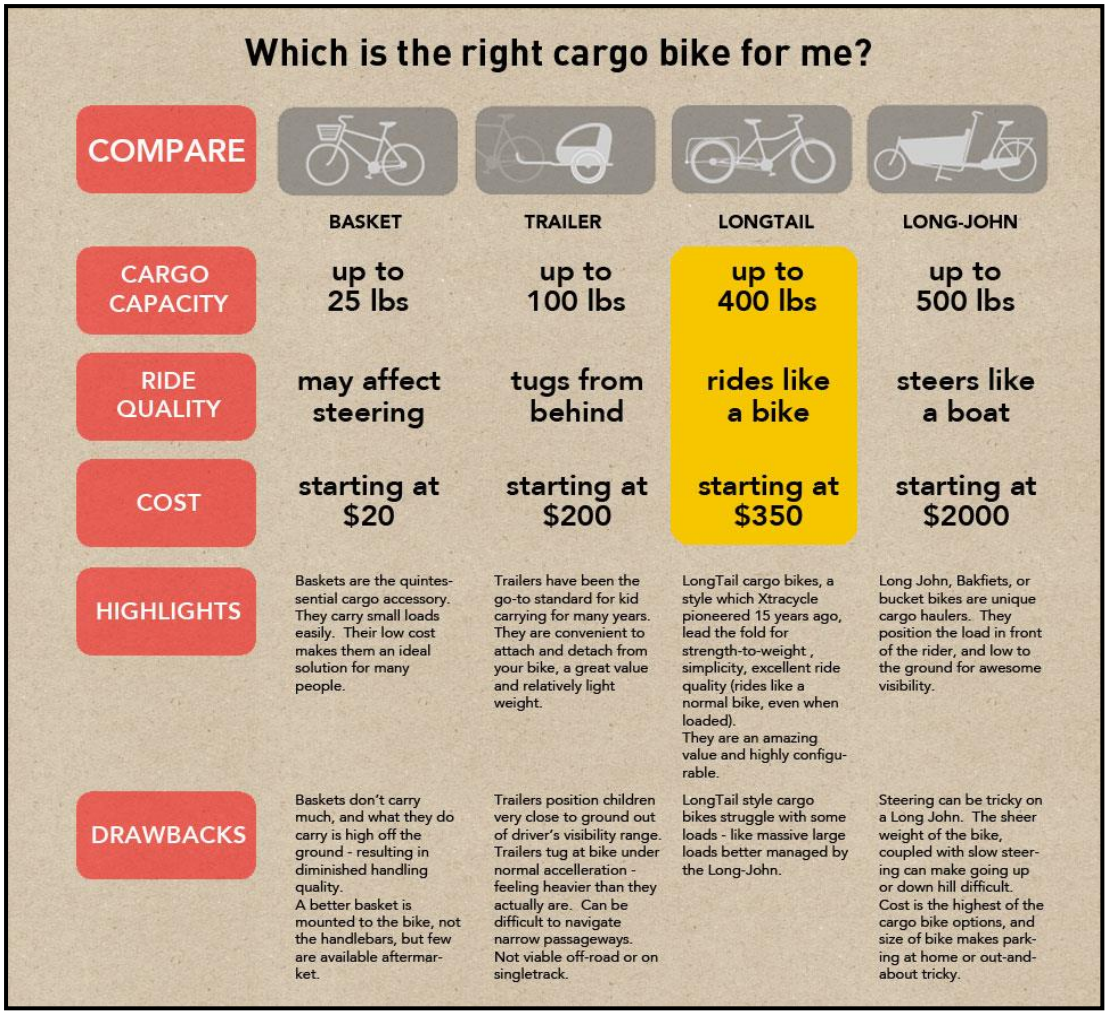



**Figure 2-2 Types of cargo bike**
(Source: http://www.xtracycle.com/what-is-a-longtail/)

Like Cox and Rzewnicki (2015), Lovejoy and Handy (2012), in offering their description of cargo cycles, present a rare discussion of the use of cargo cycles as one facet of personal logistics – the use of cycles as an everyday mode of transport to a destination - within the broader urban cycling literature. The literature which has most to say about cargo cycles is a branch of transport logistics scholarship, which focuses on the use of cargo cycles for logistical purposes, now known as cycle logistics.

## 2.6 **Cycle logistics**

In common with other researchers in the field of commercial logistics, the EU CycleLogistics research makes use of the term logistics – the transport of goods from A to B – to describe the use of cargo cycles in the urban environment (CycleLogistics, 2012). According to their typology, logistics in general and more specifically cycle logistics can be used to refer to a series of

partially overlapping categories, distinguished by the type of goods being transported, and the purpose of the trip. However, what stands out about their use of cycle logistics, is the broadening of the field beyond the various forms of commercial cycle logistics discussed below, to also incorporate municipal and personal cycle logistics. For simplicity, here I subdivide my review of the literature based upon the commercial, municipal, personal or domestic, and social enterprise cycle logistics categories. However, this is not the only way to draw distinctions within cycle logistics (Figure 2-3). For instance:

1. There are different forms of commercial cycle logistics based upon not only the service being provided but also who is operating that service.
2. Municipal logistics may operate in the commercial or non-commercial realm and may overlap with not for profit social enterprises.
3. Personal logistics may be solely in the private realm or overlap with the business realm if, for instance, someone uses the same cargo cycle to cycle to work and then use it for business purposes.

The clear message from these examples is that cargo cycles have the potential to meet a variety of transportation requirements within the urban environment.

CycleLogistics concludes that in a European context, 42 percent of all motorised trips in EU cities could be shifted to pedal cycles, and 51 percent of all private and commercial motorised trips which involve the transportation of goods, could be transferred to cargo cycles (CycleLogistics, 2012). This opinion does not have universal application, however, with analysis in the US suggesting that inner-city deliveries made with alternative fuels and vehicles are only capable of 'low effectiveness' (Guiliano, et al.,2013 as cited in Gruber et al., 2014: 53), although it is concluded that they may have application in some cities including New York (Conway et al., 2012).

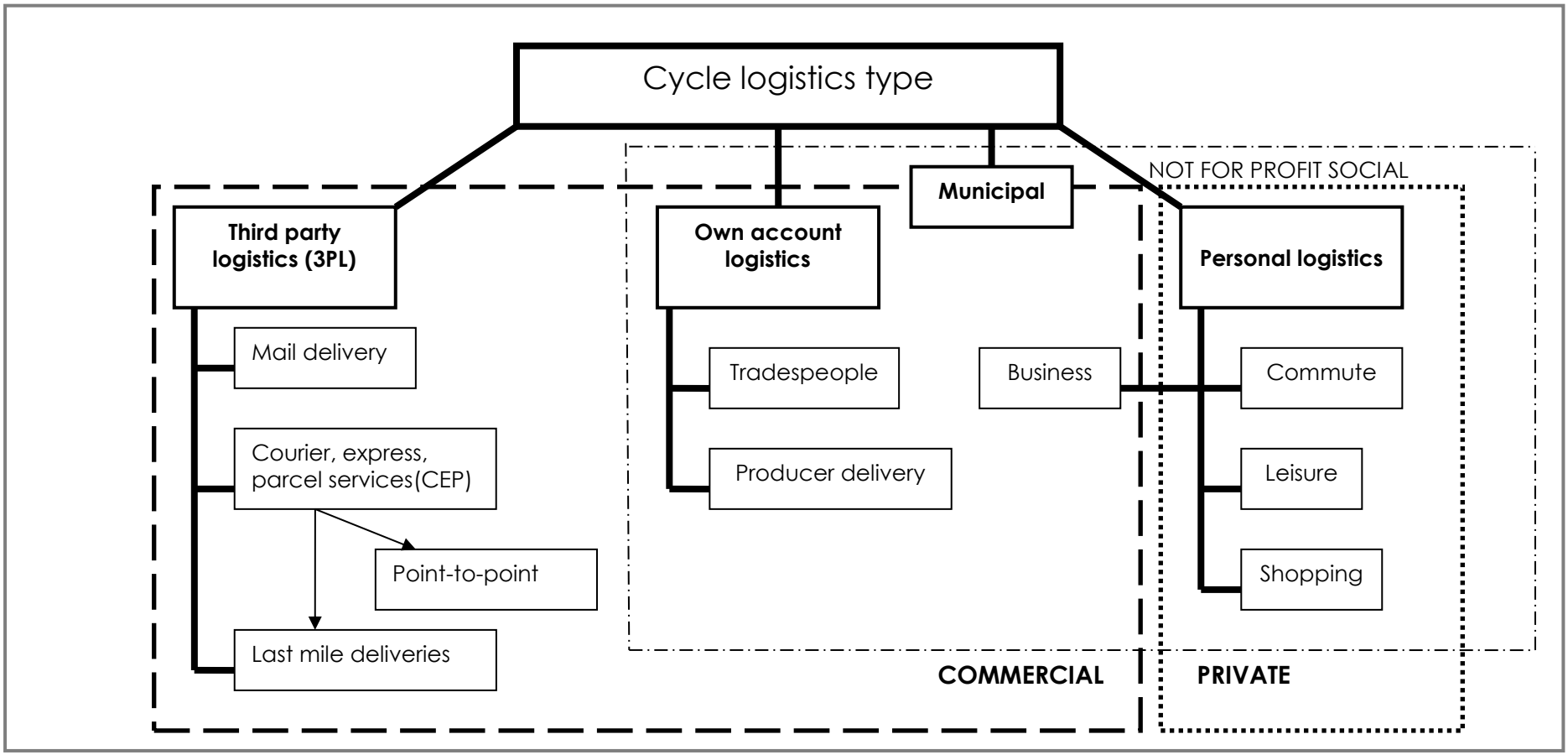



**Figure 2-3 Types of commercial and private logistics relevant to cargo-cycling**

### 2.6.1 Commercial logistics

Whilst a number of cargo cycles already described (Table 1 and Figure 2-2) are used for personal, municipal and commercial logistics, cargo cycles with larger capacities are usually preferred for commercial and municipal logistics. A range of designs of cargo cycle have also been specifically developed for this market (Figure 2-4), and it is this market which has also led the inclusion of E-assist to increase the range, speed, and terrain capabilities of the cycles, and help to overcome rider fatigue.

Within the extensive literature on urban freight logistics, including in the case of Crawford (2012) a speculative examination of the potential for freight movement by modes other than the automobile in car–free cities, there is little attention given to the use of pedal cycles for such freight movements. For instance, in their 2011 edited volume, Macharis and Melo assemble contributions focused on issues including urban freight transport sustainability (Quak, 2011), last mile freight logistics innovation (Gevaers, Van de Voorde, & Vanelslander, 2011) and guidelines for urban freight logistics practitioners (Dablanc, 2011a) but make no mention of cargo cycles. Quak (2011), while not referring specifically to cargo cycles concludes that intermodal urban freight transport 'is feasible only in specific circumstances and for a limited part of the of the total urban freight transport volume' (p. 52).

However, despite this low level of attention to cycle logistics within the broader logistics literature, by far the largest literature regarding the use of cargo cycle relates to carriage of freight, usually for commercial purposes. From a marketing history perspective, Petty (2001) reviews the history of pedal cycle use to deliver freight, and Rogers (2002) assesses the viability of the use of pedal cycles for urban freight delivery in three cities in the UK. In terms of cost, range, and payload for courier-based services, E-assist cargo bikes are found to sit between but overlap with pedal cycles and cars (Gruber et al., 2014).


**Figure 2-4 Commercial cargo cycles**
(source: author photos except top left http://8freight.com/case-studies/ and bottom left http://www.usatoday.com/story/tech/2014/05/02/eco-friendly-electric-tricycle/8640489/)

Cargo cycle use for freight logistics in Europe occurs only in cities with populations greater than 100,000 inhabitants and is concentrated in the cities of Western and Central Europe, including companies in the UK, Belgium, Austria, Germany and Spain. The largest number of companies, eight as of 2013 were found in the UK (Lenz & Riehle, 2013). Most of these companies are small businesses or one person operations, with many having less than 15 employees, many founded on cargo cycle use. Large national and international companies also operate cargo cycles, but the numbers are small relative to the number of employees. The French company La

Petite Reine is an exception, operating 80 cargo cycles (Lenz & Riehle, 2013). Conway et al. (2012) have analysed the opportunities and challenges of implementing cargo cycle-based freight distribution in Downtown and Midtown Manhattan, New York, concluding that they would not increase overall costs for last mile deliveries, and would 'reduce social externalities' (p. 14). Dablanc et al. (2014), in their international analysis of urban freight management best practice, concede that niche markets for such freight services may exist in high density US cities like New York, Chicago, and Boston, but that the market would be limited, thus limiting the potential for emissions reductions.

*Cycle freight in London: a scoping study* (Transport for London, 2009), offered the first structured potential analysis of cargo cycle use in urban freight logistics (Gruber et al., 2013). It finds practical advantages in the use of cargo cycles for freight delivery. These practical advantages are advanced in comparison to motorised freight movement and include low purchase price and running costs, avoidance of parking (and where applicable) congestion charging, high relative speeds in congested traffic, straightforward rider training, and low environmental impact. From a freight carriage perspective, these benefits need to be viewed against several disadvantages which include security concerns, rider fatigue, limitations on range and payload, and seasonality issues. Further considerations include the design of cycle lanes and paths, where width restriction may limit their use by wider cargo bikes (Rogers, 2002), and the impact of carrying heavy loads on maintenance costs, including the frequent replacement of wheels (Dablanc, 2013). These factors relate most specifically to commercial freight operations, but also have relevance to non-commercial use of cargo bikes (Transport for London, 2009). Since this study was undertaken more cargo bike designs have become available from new and established cycle manufacturers, media and public awareness has increased dramatically (Gruber et al., 2013), and the EU funded CycleLogistics project has further raised public, local government and business based awareness (CycleLogistics, n.d.).

The CycleLogistics project draws similar conclusions to the TfL study, identifying three major economic and infrastructural advantages of using cargo cycles, rather than motor vehicles, to move goods in urban areas:

1. Cargo cycles can operate in dense road networks having a smaller footprint than motorised vehicles.

2. Related to the first point, cargo cycles require smaller parking spaces than motorised vehicle and can access pedestrian zones for delivery purposes.
3. For distances up to four kilometres, and particularly at peak travel times, cargo cycles are faster than their motorised alternatives (CycleLogistics, 2012).

Crawford (2012), aspiring to car free cities, admits 'moving freight remains the greatest challenge in the development of workable car free cities' (p. 54). He distinguishes three categories of freight movement that take place in the city, external, internal, and local, stating that internationally, the 'mainstay of local delivery … is some form of bicycle' (p. 60). Similar to other writers, Crawford concludes that a cargo cycle payload of:

> 200kg is practical. Above this, some form of battery power makes sense, owing to the increased productivity of the drivers. Modern freight bikes are lightweight, have flexible gearing, a low load platform, and high capacity. These bikes are expensive to purchase but cost hardly anything to use (p. 60).

A number of cargo cycles meet this criterion (Figure 2-2 and Table 1). E-assist is integrated into some designs and can be retrofitted to the remainder. The use of E-assist is currently attracting attention as a means of making urban transport more sustainable, partly because of their ability to overcome some of the limitations (Gruber et al., 2014; Lenz & Riehle, 2013) addressed in the TfL (2009) study such as rider fatigue, range, and payload restrictions.

The logistics industry employs specific terminology to describe freight movements, such as business to business ($B_2B$), business to consumer ($B_2C$) (CycleLogistics, 2011). $B_2B$ and $B_2C$ freight movements are frequently achieved using so-called courier, express and parcel delivery (CEP) services (Gruber et al., 2013; Lenz & Riehle, 2013), often operated by third party logistics companies (3PLs) (Figure 2-3). CycleLogistics (2014a) conclude that there are three main types of service that cycle-based freight movement can provide and three further areas which have potential for development. The three main services are mail delivery, point-to-point, and last mile services, while services which show potential include bike-train-bike services, first mile (on-forwarding) and advertising. Mail services have a long history of being cycle based (Basterfield, 2011), and companies offering alternative local services to national carriers have developed in a number of countries. Point-to-point services operated by pedal cycle couriers or messengers are a proven concept capable of offering fast and reliable services within congested urban areas, with cargo cycles

offering the opportunity to overcome weight and volume restrictions (Maes & Vanelslander, 2012). Last mile (Gevaers et al., 2011) or last kilometre (Suksri et al., 2012) deliveries, are defined as the final leg of a business-to-consumer logistics chain, as for instance represented in direct sales to consumers via the internet (e-commerce) (Gevaers et al., 2011). Maes and Vanelslander (2012) believe that cycle based last mile deliveries offer efficiency and reliability improvements to the last mile of logistics chains, conventionally the most costly and troublesome section of the supply chain (Rogers, 2002). These deliveries often involve the use of urban consolidation centres (UCCs), which have proved successful in a number of countries.

UCCs are logistics spaces located in or adjacent to a delivery area such as a central business district (CBD). These UCCs are operated privately, or via public-private partnerships, consolidating deliveries from multiple sources onto smaller cleaner vehicles for final delivery (Conway et al., 2012; CycleLogistics, 2014a; Rogers, 2002). Urban micro-consolidation centres (UMCs) - a small urban proximity logistic space or hub - utilise cargo cycles and E-assist cargo bikes and also sometimes electric vans, for the final, last mile deliveries (Browne, Allen, & Leonardi, 2011; Conway et al., 2012; Sugar Logistics, 2011). A number of reports present case studies of such operations, and two trials of cargo cycles being used in association with UCCs in Paris and London have proved to be successful (Browne et al., 2011; Gruber et al., 2014). For example, La Petite Reine operates in four French cities. As of 2012 in Paris alone the company was making 3,500 deliveries per day (Conway et al., 2012; Dablanc, 2011b), annually delivering more than one million parcels using 80 cargo cycles (Dablanc, 2013; Lenz & Riehle, 2013). A recent study by Ducret (2014), identifies the use of mobile city hubs where vans, trains, and barges, used as mobile storage facilities, are moved between city destinations on a cyclical basis. The French company Vert Chez Vous has implemented this technique on the River Seine, using a warehouse barge (BESTFACT, n.d.) and a fleet of E-assist cargo bikes carried on board (Janjevic & Ndiaye, 2014).

Lenz and Riehle (2013) conclude that CEP services, and catering product delivery offer the greatest potential for the growth of cycle freight, due to low delivery volumes and weights, with 'provision of space for depots on the edge of the city centre [being an] … essential precondition to improve the potential for cargo bike delivery' (p. 44). Congestion charging and car parking costs are also incentives. With more

appreciation of cargo cycles as suitable modes of transport and more attention by urban planners to the infrastructural needs of cycle freight delivery, Lenz and Riehle estimate that in the medium term, cycle freight could account for 25 percent of city centre commercial traffic. Gruber et al. (2013) find a technical substitution potential from LDVs to E-assist cargo bikes of 19 to 48 percent of distance travelled, leading them to assert that:

> Electrically-assisted cargo bikes could be a low-threshold form for electric mobility with high sustainability and a quick amortization in urban freight transport, especially for point-to-point courier deliveries (p. 3).

They particularly identify freight movement of less than 15 kilometres in central urban areas where there are significant risks of congestion, as being a potential market place for E-assist cargo bike deliveries. Their ex-ante evaluation of E-assist cargo bike use for courier services in Germany finds that both current car and bike messengers see the E-assist cargo bike as a suitable mode for courier deliveries, potentially stimulating public attention, new customers, and environmental protection. Lack of information regarding E-assist cargo bikes and concern about range per recharge and purchase price were all identified as concerns, leading to the conclusion that an appropriate mix of conditions, regulations, and incentives will be required to motivate the use of E-assist cargo bikes by operators and riders.

Bike-train-bike services – services which extend beyond the normal local area of other cycle delivery services - rely on regular train services, but have the potential to offer an alternative to motorised road transport (Rogers, 2002). First mile services are argued to be a natural progression from last mile services, with the focus now being on collecting from customers and delivering to a hub for on-forwarding. The last area of potential is advertising which is already being combined with existing services, providing an additional potential income stream. Cargo cycles can either be branded, or cargo box advertising space can be sold on a rolling short-term basis (CycleLogistics, 2014a), in the same way as for instance advertising is placed on public transport. A number of last mile cycle logistics and pedicab based passenger transport companies incorporate the sale of advertising into their business model. The TfL report also identified some potential for shopping delivery services, such as multi-drop rounds from food outlets, florists and printers, and intra-organisational deliveries, such as for local authorities and other statutory bodies (Transport for London, 2009).

### 2.6.2 Municipal logistics

Municipal logistics encompass the range of services provided within a territorial boundary by local government on behalf of residents. Such services can include inter-office document delivery, road and park maintenance, street cleaning and graffiti removal (CycleLogistics, 2013). The advantages of operating services of this kind using cargo cycles are similar to the advantages for freight logistics, in terms of efficiency, effectiveness, reduced emissions and congestion, and ultimately cost savings. Depending on the jurisdiction, emergency services such as the police, paramedics and disaster response teams might also be included within this category (Chapter 7 focuses on cargo bikes in disaster response situations), and the use of cargo cycles by these groups, as well as by local authorities is already established.

### 2.6.3 Personal logistics

Personal logistics is a broad category comprising commuting, transporting people and goods for activities such as travel to school and shopping, leisure travel including sporting and social activities. Although historically less common, this use of cargo bikes is not entirely new (Figure 2-5).

**Figure 2-5 1930 Brown Bros Pram-cycle**
(source: Basterfield (2011))

Data assembled in reports such as those published by the City of Copenhagen (2015) reinforce the level of cargo bike use for carrying children. Research shows that most of the cargo bikes in Copenhagen are used for personal logistics, with businesses in the Netherlands and Denmark being regarded as 'conservative in their choice of transportation and therefore car orientated' (Lenz & Riehle, 2013: 42). Blogger Mikael Colville-Andersen (2015) reports there being 40,000 cargo cycles (six percent of all pedal cycles) in Greater Copenhagen. On 6 May 2015, he and a group of helpers

counted the cargo bikes passing through the Søtorvet intersection in Copenhagen over a ten hour period (Figure 2-6). He notes, that despite men dominating the ridership of cargo bikes at this particular intersection, which is primarily used by commuters, in the neighbourhoods the gender split is more equal, and that 'woman decides the brand that the family will buy' (para.11). There is little other literature on the use of cargo cycles for personal cycle logistical needs in Western countries, whether they be transporting children, shopping, and other logistical tasks or the trip-chaining particularly associated with women's mobility needs (Dickinson et al., 2003; Godefrooij et al., 2009). The literature that does exist is European in origin.

The CycleLogistics project finds significant potential for the growth of personal cycle logistics. It concludes that in European urban areas, there is potential to move 42 percent of all motorised trips to cycle-based transport, because these trips: involve light goods transport weighing up to 200kg, are short (less than 5km for a cycle and less than 7km for an E-assist cargo bikes), and are not part of complex trip trains that include car use. Overall 70 percent of trips are found to be for personal logistical purposes, with 40 percent of those trips having the potential to be shifted to pedal cycles, as compared to 30 percent of commercial trips (CycleLogistics, 2014b)

In a study of urban transport transition in Copenhagen, Gössling (2013), using content and discourse analysis of the documents published on cycling by the City of Copenhagen, points to the strong association between cycling and a positive urban vision. In particular Gössling notes:

> The choice of photographs includes healthy looking bicyclists – mothers with young children, elderly, people belonging to different religious groups, overweight cyclists, as well as men in business suits, all moving leisurely or at brisk speeds in different weather situations, conveying the message that cycling is a cultural norm and pleasurable for everyone (p. 201).

These photographs are coupled with slogans which promote the normality and benefits of cycling for individuals and society. Cargo cycles are described as 'the SUV of the Copenhageners' (City of Copenhagen, n.d.-b), and pictures of cargo cycles in use are captioned as 'Copenhagen soccer mom' (City of Copenhagen, 2009) and 'Copenhagen SUV' (City of Copenhagen, 2009) (Figure 2-7).

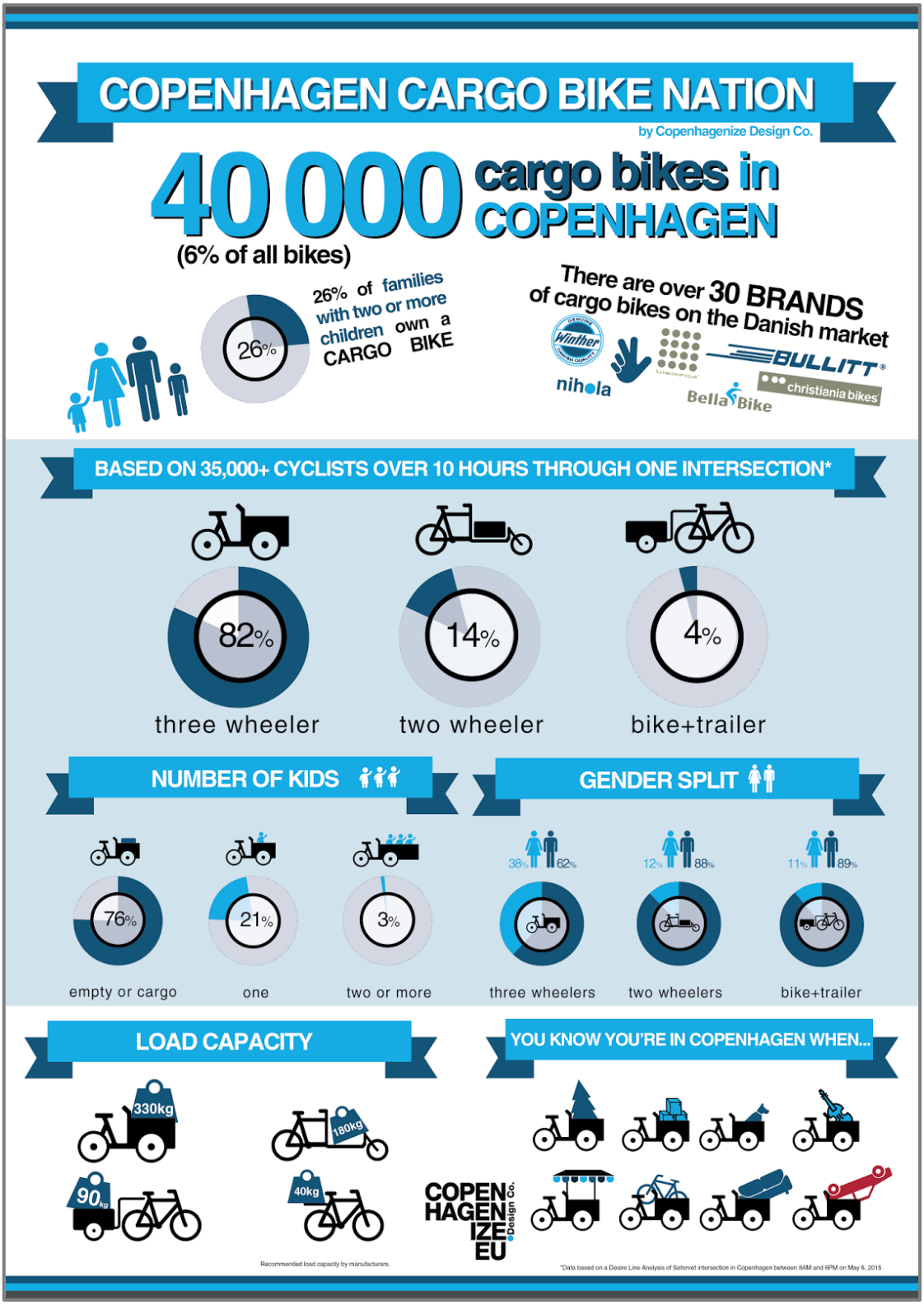



**Figure 2-6 Cargo bike use in Copenhagen**
(source: Colville-Andersen (2015))

.

In another examination of Copenhagen cycle policy, Jensen (2013) claims that cycle mobility, as an a everyday form of urban mobility, is as significant for Copenhagen as automobility. She describes the normalisation of cycling and its representation as 'something authentic and Danish' (p. 222) and specific to Copenhagen. Within this cultural norm, the development of the Christiania cargo trike (Table 1 tadpole cargo trike) in Copenhagen, is presented as offering a more spacious and capacious cycle technology relevant to 'family life' (p. 222). Despite the fact that 'many people increase their car use with the arrival of children (Christensen & Jensen, 2008), the box [cargo] cycles made cycling compatible with a wider range of family positions and stages in lives … [also being] present in children's daily activities' (Jensen, 2013: 222) with family, friends, and school.


**Figure 2-7 Representations of cargo cycle use in Copenhagen**
(source: City of Copenhagen (2009) and CycleLogistics (n.d.))

Moving beyond the cargo cycle capital of Copenhagen, Crawford (2012), in his conceptualisation of the car free city, sees cargo cycles as presenting a mode of transporting goods between shops and dwellings. Meanwhile, Martinez (2011) asks whether there might be a market for cargo cycles, primarily for transporting children, in the London Borough of Hackney. She concludes, that there are several

characteristics of Hackney that suggest a demand for cargo cycles might arise. These include, as in Copenhagen (Jensen, 2013), the relative normalisation of cycling in the borough, coupled with low car ownership and use rates. The borough has also experienced a particular form of gentrification, incorporating professionals, artists, and so-called creatives:

> who are likely to be attracted by the subcultural, environmental, and political connotations of cycling. Moreover, many are now in their thirties and having children. A third factor is the embedding of cycling into community practices and organisations: some of Hackney's schools strongly promote cycling and there are many bike shops, as well as cycling clubs, cafes, organisations, and festivals (Aldred cited in Martinez, 2011: 32).

Thus this review of cycle logistics across commercial, municipal and personal domains, shows commonalities but also contrasts in terms of the relative importance of range and reliability in the commercial domain, and the importance of social norms in the personal domain. I now turn to one further cross-cutting domain (Figure 2-3) - not-for profit social enterprise logistics

### 2.6.4 Social enterprise logistics

As noted previously cycling is routinely valorised not only for its sustainability but also for its egalitarian credentials (Kenworthy, 2007), with cycle activists seeing pedal cycles as more than transport 'as literally a vehicle of social change' (Cox, 2013: 122). Women, children and those on low incomes are most likely to have their mobility restricted in car-centric transportation systems, while lack of access to transport reduces access to employment, education, shopping facilities and social activities (Godefrooij et al., 2009).

Social enterprises provide services which benefit the community, and 'social responsibility and environmental well-being fits well with cycle powered service provision' (CycleLogistics, 2013: 12-13). Whilst there are many examples of cycle focused social enterprises, there are few which specifically concentrate on cargo cycles and even less analysis of such schemes within the academic literature. Pedicabs or cycle taxis can be considered non-motorised public transport capable of carrying several passengers (Rahman, D'Este, & Bunker, 2010). Commercial cycle taxis or rickshaws are widespread in developing countries (Cox & Rzewnicki, 2015; Norcliffe, 2011), and have spread to Western countries in the last 15-20 years. Cox and Rzewnicki (2015: 133) observe, that internationally the various forms of rickshaw are 'almost certainly the most numerous type of working cycle in existence

today', particularly in South Asian cities (Tiwari, 2014). Modern pedicabs are built to a number of designs, although most are three-wheeled and some incorporate E-assistance and they vary in level of enclosure (Schlesinger et al., 2013).

With their relatively low start-up costs, pedicab based businesses have become increasingly common in Western cities, primarily focused on the tourist and recreation markets (Schlesinger et al., 2013). However, in some locations where access is too narrow, or motor vehicles are excluded pedicabs offer a successful alternative to conventional taxis (Basterfield, 2011). An action research project, which investigated and generated action on a number of UK-based small-scale cycling projects focusing on the links between such projects and social inclusion, was carried out by the London School of Economics and Political Science (LSE) between 1998 and 2000. As part of this research, four pilot cycling projects were established in two London boroughs (Elster, 2000). One of these projects, located on the Downham estate in the London Borough of Lewisham, made use of two pedicabs to provide lifts and shopping deliveries to socially isolated older people living on the estate (Church & Elster, 2002). Elster (2003) reports that the researchers originally had concerns about promoting cycling to overcome problems of poor transport provision in impoverished areas. For instance:

> Many people aspire to owning a car and are not interested in cycling; there are many cases where cycling is not a practical solution, for example for the elderly and people with young children, and we did not want cycling to appear as a 'poor man's [sic] alternative' (Elster, 2003, p. 600).

However, initial research suggested that cycling projects had the potential to help overcome social exclusion, by improving people's confidence and skill sets and providing new services. The Downham Cycle Taxis Project was launched in July 1999, and three years later was being used as a subsidised taxi service by approximately 60 elderly people each week, as well as providing a home delivery service (Church & Elster, 2002; Elster, 2000, 2003; Esler, 2003). Project evaluation showed the benefits of the project to include flexibility, freedom, social contact, informal support and maintenance of independence for users, increased personal safety, employment in an area of high unemployment, and sustainable community transport (Elster, 2003). Thus, while this sort of project can achieve outcomes similar to other community action projects, such as community cafes, crèches, and youth work, it also combines social, economic and environmental benefits via the provision of sustainable decarbonised mobility. Elster and colleagues conclude that

such projects have the potential to 'interest and engage a much wider audience than conventional approaches to cycling promotion centred on the benefits of cycling as a means of transport and for health and leisure' (Elster, 2003: 611). Thus, the project responds to identified community needs for social contact, transport, and employment, with cargo-cycling being the tool to address those needs, rather than the focus being primarily on increasing cycling participation. As Elster makes clear, this emphasis on wider community needs has the potential to engage policy-makers tasked with addressing issues of criminal reoffending, unemployment and welfare dependence, issues which are much higher up government policy agendas than promoting cycling in a more general sense.

## 2.7 **Cargo-cycling in New Zealand**

All the aspects of load-carrying cycle logistics reviewed in this chapter have potential relevance to urban New Zealand, but to date, attention to any form of cycle logistics in New Zealand has been has been minimal. In their NZTA report *'I'll just take the car' improving bicycle transportation to encourage its use on short trips*, Smith, Wilson and Armstrong (2011) found that cycling related products for sale in New Zealand are 'heavily biased towards recreational cycling' (p. 7), thereby limiting the availability of products designed specifically for cycle-based urban mobility. Likewise, in Taylor's (2009) study of utilitarian cycling in Christchurch, some participants 'found the range of bicycles available … restrictive for commuter cycling' (p. 141). Smith et al. include four designs of two-wheel cargo bikes in their fieldwork (Figure 2-8). They find cargo bikes and E-assist pedal cycles, at their time of writing, to be some of the most suitable cycles for urban mobility, but among the hardest to access in New Zealand. This NZTA research used practical cycling workshops conducted in Dunedin, New Zealand to gauge participants' perception of the use of cycles designed for cycle-based urban mobility. The results revealed that direct experience improved the perception of cycle-based urban mobility, increased aspiration to cycle, and helped to remove perceived barriers.

**Figure 2-8 Types of cargo cycle identified by Smith et al. (2011: 51)**

## 2.8 **Concluding remarks**

This research investigates the contribution cargo cycles can make to decarbonised urban mobility. The literature reviewed offers elements of a response, particularly regarding commercial logistics in European cities. Cargo cycles are identified as suitable for urban transport, across a number of domains. A core group of researchers have, in particular, considered the use of cargo cycles within the domain of commercial logistics in Europe, and to a lesser extent the US. Within this domain, the major focus is on last mile and CEP services. Evidence from Paris, considered by Dablanc (2011b) to be 'one of the most active European cities in the field of urban freight' (p. 1), is that local emissions can be successfully reduced, but globally initiatives thus far implemented only impact on a very small share of urban freight flows.

It is clear that technology cannot be appraised in isolation, but needs to be seen as one element within a dynamic system of overlapping practices. The technology still requires improvement to meet reliability and durability requirements, particularly in relation to wheel maintenance and the autonomy of electric-assist technology (Conway et al., 2012; Dablanc, 2011b). Evidence from Paris also shows that policy implementation is complex and slow (Dablanc, 2011b). However, with strong political support, public-private sector cooperation, and the provision of affordable, suitably sized and located UCCs initiatives such as La Petite Reine 'are easily transferable' to other cities (Dablanc, 2011b: 2). Another important lesson from Paris is to take:

> great care in inviting the press and residents' and environmental groups to events related to … freight policy … This has significantly helped raise the level of support among companies potentially interested in urban freight schemes, and has induced some of them to participate in city logistics initiatives (Dablanc, 2011b: 2).

Essentially, what is being argued is that to gain and maintain public interest and acceptance it is important to continuously engage with stakeholder groups, and in the case of cargo cycles show how this technology can blend with, and support users' existing practices.

Forms of logistics other than the commercially focused have received very little academic attention, despite evidence that suggests cargo cycles have great potential for personal logistics. This literature review clearly identifies a number of gaps in the literature, both in terms of the range of domains being researched, and the

geographical distribution of that research. Evidence from New Zealand research (Smith et al., 2011), suggests that cargo cycles are suited to the New Zealand urban environment, but not easily available. If the potential identified in this literature review for cargo cycles to assist in decarbonised mobility is to be capitalised upon, attention needs to be given to how, both in New Zealand and in other Western countries, the practice of cargo-cycling is, and can further be integrated into people's daily practices. Chapter 3 begins that appraisal by introducing practice theory and its contribution to cycling research, broadly defined.

# Chapter 3 Practicing (cargo-)cycling

## 3.1 Introduction

There are a number of theories and methods of conceptualising sustainable transport and mobility, and '[t]heories, like practices, compete with each other for advocates and carriers' (Shove et al., 2012: 139 ). This research adopts an approach informed by SPT, to consider the contribution cargo bikes can make to decarbonised urban mobility. In this chapter, recent applications of practice theory which develop an approach capable of shedding new light on mechanisms which can support the decarbonisation of urban transport, based on cycle-based urban mobility, are reviewed to identify their contributions to both the practice theoretical and urban cycling literatures. To accomplish this task, the chapter begins by positioning practice theory within the social sciences and in relation to the structure agency dualism. The foundational concerns and two subsequent waves of practice theory, and their particular preoccupations are identified, before elaborating upon the core components of the analytical affordances of SPT, as developed in theory and exemplified in cycling related empirical applications. In so doing, some of the main criticisms of practice theory are canvased. The conceptual framework thus presented, forms the foundations for the subsequent chapters of this thesis.

To date, social science-based research traditions have been in the minority when considering the decarbonisation of transportation. Much of the existing research focuses on technological change, the provision of infrastructure, market-based frameworks, and psychological theories of behaviour change, underpinned primarily by quantitative positivist epistemologies[9] (Schwanen et al., 2011). The critical social sciences look beyond mitigation based within existing political, social and economic systems and standards, to review 'the organisation of contemporary societies, the role of transport therein, justice and ethics' (Schwanen et al., 2011: 1004).

Warde (2014) argues, that the choice of theory used within a discipline is a matter of emphasis, an emphasis which can be observed to change over time in a cyclical manner. One way of thinking about how transport can be decarbonised is provided by conceptualising social order, stability, and change in a manner consistent with and systematically informed by theories of practice (Shove et al., 2012) - the practice

[9] How we know about the world.

turn in social sciences[10]. Shove (2003a) claims that practice theories are 'a different way of thinking … [rather than] … an all-encompassing theoretical *model*' (p. 20 my emphasis), there being 'no such thing as a coherent, unified 'practice theory'' (Postill, 2010: 6). Ontologically[11], practice theory centres analysis on practices, individual practitioners being subordinated to the practice itself (Aldred & Jungnickel, 2013, 2014; Pink, 2012; Watson, 2012), denying the reducibility of people's behaviours to individual attitudes and choices (Shove, 2010a; Watson, 2012). However, the approach also endeavours to avoid the effects of technological determinism, which restricts agentic opportunities for change (Aldred & Jungnickel, 2013; Hinton, 2010). Thus, 'doing something is always the *performance* of a *practice*' (Watson, 2012: 488, emphasis in original) with practice theorists seeking to gain epistemological knowledge of the world, by understanding the relationship between performances and wider society (Pink, 2012). Placing practices, not individuals or infrastructures, at the centre of analysis, reframes research questions to ask how practices rather than individuals can become, for instance, more sustainable (Spurling et al., 2013). Investigations, such as of contemporary travel patterns, become a question of asking which practices people participate in, and how they order and organise practices rather than what individuals choose to do. Consequently, seeking to influence mobility patterns and the decarbonisation of transport requires the understanding of linkages between movement of people and practices (Hui, 2013).

Two waves of practice theory can be discerned, both having been applied to a number of academic disciplines, including the study of sustainable transport. Both cycling and driving can be understood as practices existing, but overlapping, as recognisable entities in their own right. Practice theory has been used to explore alternatives to automobility (see for example Birtchnell, 2012; Heisserer, 2013; Kent, 2013; Watson, 2012), it being commonly found that cycling offers a 'socially, economically, and ecologically sustainable alternative to the automobile for short-distance travel' (Vivanco, 2013a: 29-30). This thesis applies the work of second wave practice theorists, and in particular, the analytical simplification of SPT, as presented in the work of Shove et al. (2012). This second wave 'way of thinking' (Shove, 2003a: 20), based upon three generic 'building block' elements of practice - materials, competence, and meaning - is argued to allow identification of the dynamic

[10] Practice theories, theories of practice, and the practice turn are used interchangeably to connote 'the way of thinking' of this theoretical model (Shove, 2003a: 20). As Postill (2010: 6) clarifies 'there is no such thing as a coherent, unified 'practice theory''.
[11] How we understand what exists in the world.

emergence of patterns and connections, and description of transformation, diffusion, and circulation of practices. The bare bones of this account of the dynamics of social practice were presented in section 1.5 and are expanded upon in section 3.3. First, having begun to sketch-out the theoretical underpinnings of this thesis, I expand upon the foundational positioning of this approach.

## 3.2 The practice turn – social theory between or beyond structure and agency

The roots of practice theories are normally traced to the pragmatism of Dewey and James, Wittgenstein's ideas of the flow of praxis[12], and Heidegger's identification of praxis as a source of meaning (Schatzki, 2011; Shove et al., 2012). Warde (2014) claims the most common explanation for the emergence of practice theories to be 'the passing of economism and Marxism in the 1970s' (p. 6), encompassing concern for the character of society and the nature of human activity (Schatzki, 2011), understanding relations between structure and agency as being recursive and co-constitutive of each other (Watson, 2012). This first wave includes social theorists such as Giddens and Bourdieu, cultural theorists including Foucault, and theorists of science and technology including Latour (Postill, 2010; Schatzki, 2001; Schatzki, Knorr-Cetina, & von Savigny, 2001). The second wave is generally agreed to correspond with advances in theorisation starting with Theodore Schatzki and Andreas Reckwitz, with sociologists Alan Warde and Elizabeth Shove being prominent in furthering the diffusion of practice theory across 'epistemic space' (Postill, 2010: 12). Thus, whilst the practice turn does not represent one unified approach its proponents do share a concern with challenging the actor-structure dualism and the 'attention to consumer behaviour [that] has become … popular … in policy rhetoric' (McMeekin & Southerton, 2012: 346).

### 3.2.1 First wave

Giddens' (1984) theory of structuration explains social practices as mediating between structure and agency (Figure 3-1), with 'both social order and individuality … result[ing] from practice' (Schatzki, 1996: 13), the 'skilled body' (Schatzki, 2001: 3) being where activity, mind, society and the individual meet, so that social practices are at the centre of attention, the site of the social, the ontological units of analysis (Reckwitz, 2002; Røpke, 2009; Watson, 2012). Bourdieu, while not forming a consistent theory of practice (Shove et al., 2012), did in his theorising of *habitus*

[12] practical knowledge or know-how

construct some of the foundations on which the practice turn is now built. For Bourdieu habitus is 'constituted in practice and is always orientated towards practical functionings' (Bourdieu, 1990: 52).

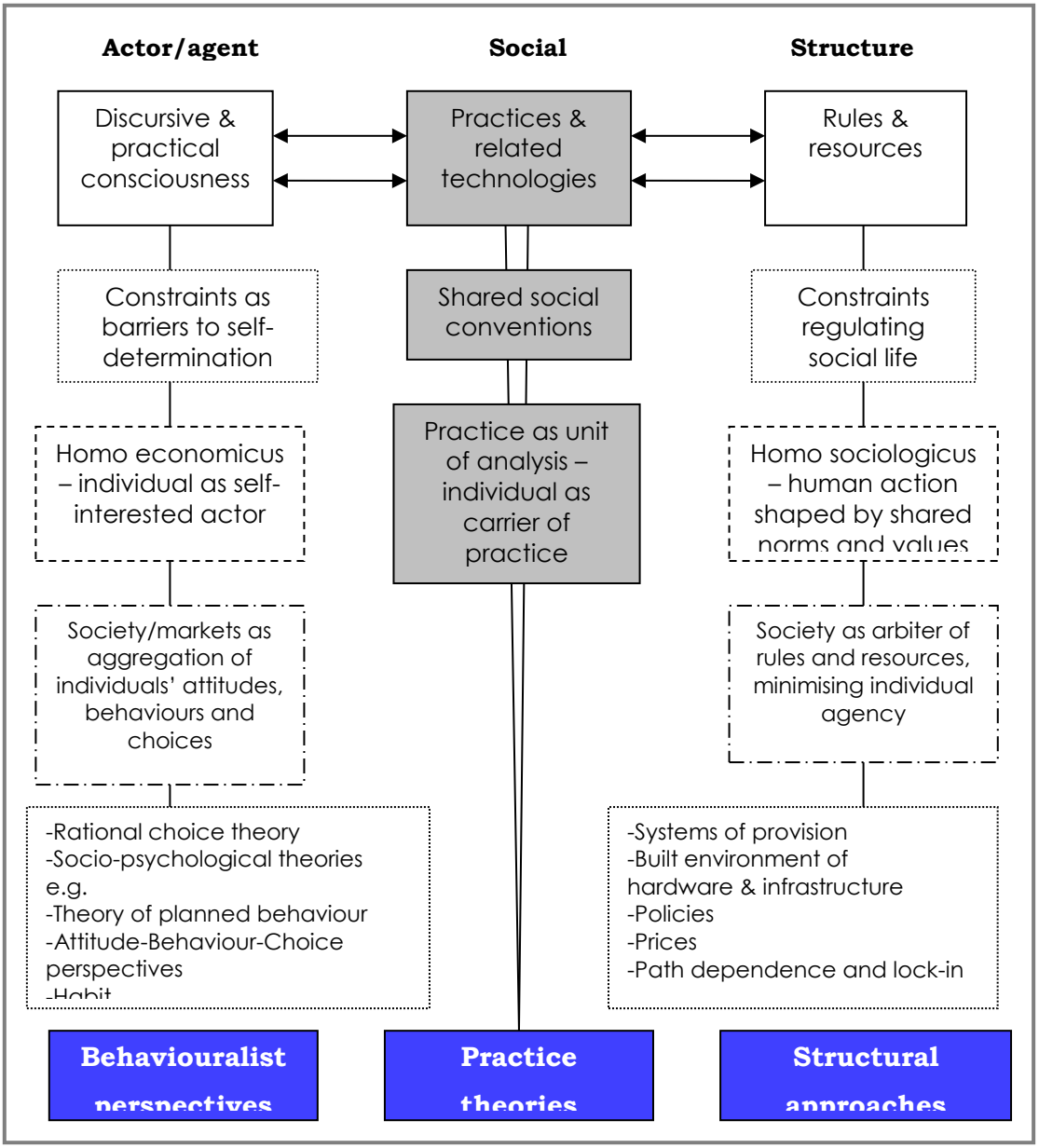



**Figure 3-1 Actor-structure relationships and points of difference with practice theory**
(source: adapted from Shove (2006a), Shove et al. (2012), Seyfang (2009) and Heisserer (2013))

Everts, Lahr and Watson (2011) claim that it was the work of Bourdieu and Giddens that first motivated geographers to make significant use of practice theory, such as Thrift's (2008) non-representational theory which includes some of the core implications of the practice turn (Everts et al., 2011). Unlike most recent applications of the practice turn to cycling related research, Nettleton and Green's (2014) sociological analysis of changing mobility practices specifically draws upon

Bourdieu's (1977) *Outline of a Theory of Practice.* In the context of the minimal international success of policies aimed at encouraging active mobility, Nettleton and Green consider how and why mobility practices might change. They point to both a lack of evidence to support behavioural interventions (see for instance Ogilvie et al., 2004) and a lack of success in identifying material and social environments which support active mobility, due to deficiencies in accounting for cultural factors and generalizability (see for example Bonham & Cox, 2010; Oldenziel & de la Bruhèze, 2011; Oosterhuis, 2014).

What is important for Nettleton and Green, is that analysis of qualitative data should 'examine the interplay between context, circumstance, and practice in order to decipher the informants' implicit assumptions … because practical (rather than cognitive or intellectual) reasoning underpins action' (2014: 241). Nettleton and Green apply these insights to studies including Steinbach, Green, Datta and Edwards' (2011) examination of why women and some minority ethnic groups are not well represented among those cycling as a mode of transport in London.

### 3.2.2 Second wave

Towards the close of the twentieth century, the second generation of practice theorists contributed to these theories gaining new momentum (Postill, 2010; Watson, 2012). Philosopher Theodore Schatzki and cultural sociologist Andreas Reckwitz have both had significant influence on contemporary practice theoretical developments, by furthering development of the first wave in the direction of a 'philosophy of action' (Warde, 2014: 285). Schatzki's (1996) comprehensive elucidation of a Wittgensteinian social practice theory has been highly influential, with the essays collected in *The Practice Turn in Contemporary Theory* (Schatzki et al., 2001), reflecting the diversity of theoretical positions to be found within the practice turn, including post-functionalist, post-structuralist and post-humanist perspectives (Warde, 2014).

The temporal and spatial aspects of practice have been significant features of Schatzki's exposition, with a practice being defined as a coordinated entity (Christensen & Røpke, 2010), a 'temporally unfolding and spatially dispersed nexus of doings and sayings' (Schatzki, 1996: 89), which follow specific rules. Schatzki developed the two central ideas of contemporary practice theory, practice-as-performance – the activities of individual practitioners making up the practice - and

practice-as-entity – the organisation of a practice via normative rules, general and practical understandings, and teleoaffective structure[13] (Heisserer, 2013).

Reckwitz (2002), also defining a practice as a coordinated entity, recognises an 'ideal type of practice theory' (p. 244), locating practice theories with cultural theories which 'highlight the significance of shared or collective symbolic structures of knowledge in order to grasp both action and social order' (p. 246). Reckwitz builds on Schatzki in focusing on routine, as well as incorporating ideas from Latour's actor network theory (ANT) concerning the constitutive role of 'things' for practices (Spaargaren, 2011). Social practices become blocks or patterns of interdependencies between elements:

> a routinised type of behaviour which consists of several elements, interconnected to one another: forms of bodily activities, forms of mental activities, 'things' and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge (Reckwitz, 2002: 249).

The practices of urban mobility provide a useful exemplar of Reckwitz's characterisation. Cycling consists of an array of elements: the pedal cycle, helmet, lock, lights, road spaces; competencies in terms of the embodied skills of riding a pedal cycle, knowledge of road rules, direction finding skills, knowledge of evasive actions when presented with dangerous situations involving other road users; and meanings shared by cyclists such as efficiency, speed and sustainability, or meanings shared by non-cyclists such as for instance danger, unpredictability or counterculture. In this way, the performance of urban cycling is recognisable to cyclists and non-cyclists as an entity, the entity providing the 'blue-print' for the performance, and the performance sustaining and reproducing the entity. As can be seen from this example, Reckwitz's inclusion of 'things' is important, an emphasis on the material dimensions of practice, which in earlier work was under-theorised (Shove & Pantzar, 2005). Furthermore, the cyclist is theorised here as a carrier of the practice of cycling, rather than as an individual. Reckwitz argues that elements, such as those listed above, are 'qualities of a practice in which the single individual participates' (2002: 250) as a carrier of the practice.

[13] The normative and hierarchical goal directed 'ends, projects, and tasks, to varying degrees allied with normativized emotions and even moods' (Schatzki, 2002: 80) – what ought to be done and what is acceptable (Heisserer, 2013).

The recent philosophical accounts of practice theory developed by Schatzki and Reckwitz, the 'more classically *social* theories' (Shove et al., 2012: 120, emphasis in original), are argued to be potentially difficult to apply to empirical analysis (Warde, 2005). Difficulties result from philosophical meta-theoretical accounts being 'idealized, abstract and insufficiently attentive to the social processes involved in the creation and reproduction of practices' (Warde, 2005: 135). Philosophical descriptions also tend to assume 'almost inconceivable' near consensus in understandings, conventions, procedures, and engagements, which reinforce a critique of theories of practice which argues them to be poorly positioned to account for change (Christensen & Røpke, 2010; Warde, 2005). Another drawback of this characterisation, is the suggeston of recurrent faithful performance leading to enduring practices-as-entities, even though practices and their associated social order are expected to fade away if their practice ceases (Heisserer, 2013).

Clearly, in the case of urban cycling, cycling rates are not spatially or temporally consistent. Furthermore, the design of pedal cycles and associated equipment has changed, as has the urban environment, know-how, and meanings of what it is to cycle. Practice theories need to be able to account for such changes, whilst also accounting for the consistencies of reproduction (Shove et al., 2012). Shove and colleagues have sought to develop a series of concepts which focus on the dynamic aspects - emergence, persistence, and disappearance - of social practices. Addressing these dynamics is important, both for investigating specific social practices, and addressing persistent global problems such as climate change and issues of inequality. Attention now turns to a more detailed exploration of the core conceptual ideas of SPT.

## 3.3 **Social practice theory**

As already noted, SPT claims analytical simplicity and the ability to overcome potential difficulties in applying the 'classical' theories of practice to empirical analysis (Warde, 2005). Even for researchers adopting a broadly SPT approach, the terminology *social* practice is contentious, it being argued by some that practices are by definition social (Kuijer, 2014), and therefore, the term social practice 'says the same thing twice' (Nicolini, 2012: 227). Shove et al. (2012) specifically set themselves the 'challenge of conceptualising *social* order, stability and change … in a manner … consistently and systematically informed by theories of practice' (p. 119, emphasis added). This focus on the social, and the intention of presenting a specific and

identifiable label for their work could be presented as a justification for the identified tautology.

In developing SPT's empirical credentials, Shove and colleagues have moved beyond Schatzki's (2009: 46) inclusion of infrastructure, technology and artefacts as *aspects of* 'material arrangements', settings, context or environment, to *materiality as a constitutive element of practice* - a distinctive ontological feature of SPT (Shove, Watson, Hand, & Ingram, 2007). In so doing they have made 'selective … broadly sympathetic' (Shove et al., 2012: 9-10) use of ideas from science and technology studies (STS), ideas which distribute competence between people and things, without concurring with Law's (1991) view of materials as immutable conduits of power or anchors of social action. This inclusion of artefacts and infrastructures is what distinguishes SPT from the 'thoroughly social theories' (Shove & Pantzar, 2005: 44) of Giddens and Bourdieu. Røpke (2009) points to contemporary near universal agreement that materiality, or things, should be regarded as elements of practice.

Sitting at the intersection between STS and SPT McHardy's (2013) exploration of "electric cycling"[14] and what counts as normal practice, argues that the process of testing and evaluating E-assist bikes is a reaction to pressure to normalise such pedal cycles. In Latourian terms, McHardy describes this as a process of purification and hybridisation, where to appear normal the testing and evaluation process defines 'what counts as a normal electric bicycle' (p. 134), thereby excluding other possible material arrangements. Within this process, the tester's task is to constitute the variations in what is seen as normal cycling practice defined within the testing procedures. Reflecting on Shove and colleagues contention that as new materials and practices start to come into use, competence moves between humans and non-humans (Shove et al., 2007), McHardy argues that E-biking tightly intertwines humans and non-humans, blurring the boundaries between them. Further, he suggests, as pointed to in Pantzar and Shove (2010b), 'that there is no one practice' (McHardy, 2013: 140), because the dynamic relationship between human and non-human complicates attempts to analyse practice change, by following the circulation of elements independently of their hybridisation and incorporation within their enactment. Thus, McHardy concludes that trying to conceptualise practice as an entity risks 'skipping over the tensions that necessarily arise between normalising

[14] Cycles fitted with battery powered motors which in association with the riders own pedalling allow riders to travel further and faster than they otherwise could (McHardy, 2013), a human-electric hybrid (Cox, 2012).

practices and the multiplicity of specific practical enactments' (p. 143), a risk that may be countered by foregrounding normative tensions and contradictions when practices are regarded as 'ready-made' entities. Such issues are addressed in the next section discussing the relationship between performance and entity in SPT.

### 3.3.1 Practice-as-performance and practice-as-entity

As sketched–out in section 3.2.2, a practice based perspective regards individual behaviours as performances of a larger social phenomenon, a visible manifestation of that social entity. This perspective takes issue with framings of behaviour as the demonstration of values and attitudes (Spurling et al., 2013), instead seeing the practice-as-performance as the meaning-making, reproduction, and modification of the entity (Evans, McMeekin, & Southerton, 2012). Earlier theorists identified recurrent faithful performance of practices as the cornerstone of enduring practice-as-entities, but this interpretation does not account for ongoing, sometimes subtle changes in the performance of a practice, over time and through space (Shove et al., 2012). Schatzki (2009) conceives of an entity as the sum total of all the performances of a practice in time and space, whereas Reckwitz (2002) sees the entity as presenting a pattern to be filled out in individual performances. A simple visual metaphor used in SPT to represent the relationship between entity and performance is the iceberg (Figure 3-2), where the visible tip of the iceberg is the practice-as-performance resting upon and inseparable from the practice-as-entity. The performance of a social practice as manifested in a recognisable individual behaviour demands the successful use of materials and infrastructures, adherence to socially shared conventions, and knowledge and application of skills and know-how – the tripartite elements of the analytical simplification of SPT (Røpke, 2009; Spurling et al., 2013). These practices have to be performed to survive, and this enactment is always subject to subtle change in performance, meaning that a performance contains 'the seeds of constant change' (Warde, 2005: 141), and over time, the entity may undergo transformation. Thus, the relationship between entity and performance is recursive, and the site of reproduction and change (Evans et al., 2012), the entity both guiding and being moulded and sustained by the sum of its practices (Kuijer, 2014).

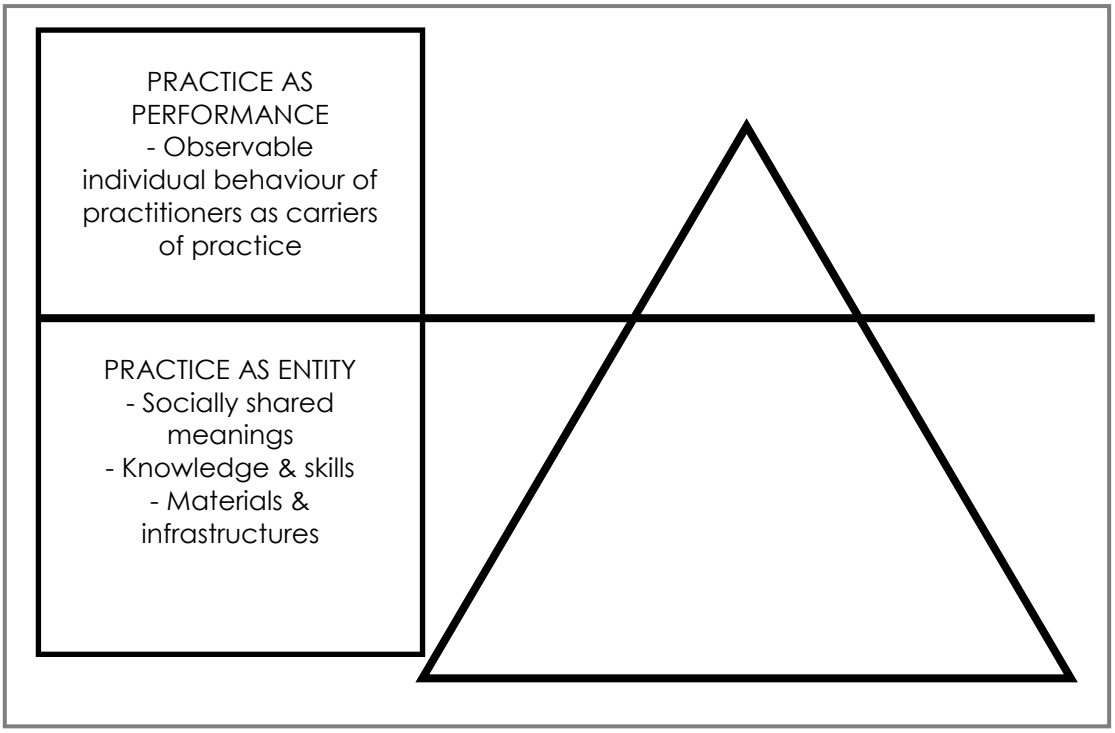



**Figure 3-2 The relationship between practice-as-entity and practice-as-performance**
(adapted from Spurling et al. (2013))

Having established the relationship between performance and entity in practice theory, I now turn to how Shove and colleagues conceptualise elements in SPT.

### 3.3.2 Elements of practice

Shove and colleagues follow Reckwitz, in conceptualising practice-as-entity as a block or pattern of interdependencies between elements (the portion of the iceberg below the waterline), which is reproduced by the practitioner(s) or carrier(s) of the practice in moments of performance (Shove et al., 2012) (the tip of the iceberg in Figure 3-2), with the practice-as-entity enduring between and during performances (Shove et al., 2007). This conceptualisation regards elements as "floating" in time and space awaiting linkage. On this basis, possibilities continuously exist for linkages to be made, sustained or broken, and therefore, the status of linkages is crucial to the ongoing 'health' of a practice-as-entity. This recursive relationship is a very different scenario to that seen in 'portfolio models' of behavioural change which see stability and routine as an end point of linear processes of normalisation (Shove et al., 2012).

While Reckwitz (2002), in his ideal-type put forward a number of elements of practice, Shove and colleagues have simplified this account to three elements - material, meaning and competence (Shove et al., 2012) (Figure 3-3), although this simplified

schema does incorporate within the three elements, the broader interdependencies described by Reckwitz. Whenever a practice is performed all these elements required must come together; if a requisite element is not available it will not be possible to perform the practice (Spurling et al., 2013). Shove (2011a) compares the elements which link in different genres of cycling, commuting, family leisure, road racing, and mountain biking, comparing for instance the different levels of fitness required for road racing compared with leisure cycling, and the functional, health, and money savings images of commuter cycling compared with the "adrenalin packed", trendy, adventure seeking images of mountain biking. She also shows that over time, the relative significance of different types of elements change. This can be illustrated by comparing changes in, the range of competences required to cycle commute as roads have become busier, the increasing availability of different types of pedal cycles, and the decline in the positive reinforcement meanings of cycle commuting in many Anglophone countries.

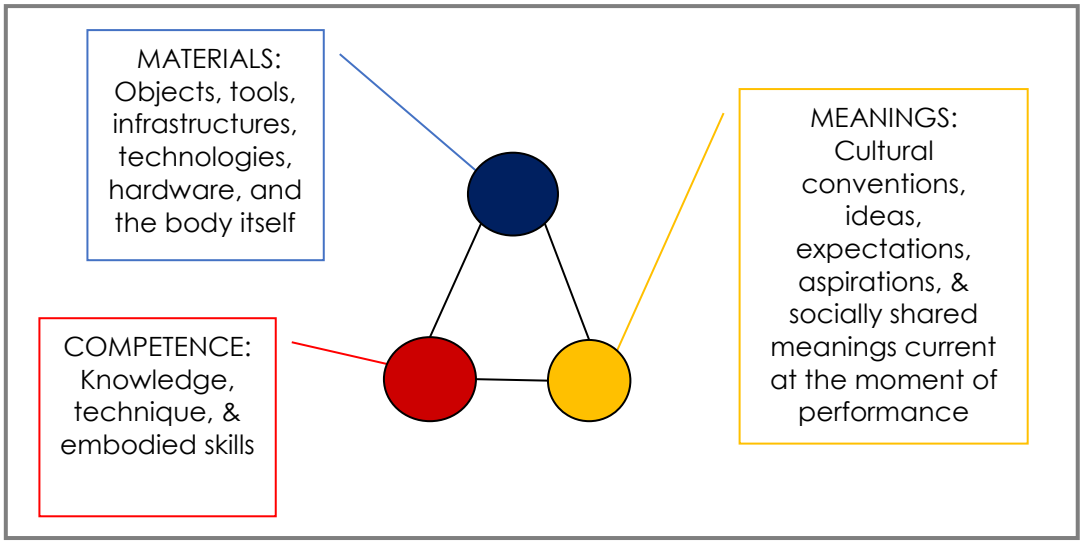



**Figure 3-3 Elements of the practice of cargo-cycling**
(adapted from Shove et al. (2012))

The ramifications of the requirement for elements to be maintained in juxtaposition by linkages is important for practice theories, raising questions of 1) the sharing of elements between practices; 2) how practices recruit, persist, and disappear; 3) how bundles of practices form, persist, and disappear; and 4) how practices, elements, and the links between them are generated, renewed, and reproduced. These ramifications are now addressed.

### 3.3.3 Sharing elements between practices

Because practices do not exist in isolation, both inter-practice and intra-practice linkages require examination. For instance, Shove (2011a) asks which elements are shared between different commuting practices, and which are in conflict, as knowledge of this sharing may be important in contexts including the design of policies aimed at promoting modal shift. Further, although a common element may be a pedal cycle, it is not necessarily the same type of pedal cycle in each practice. What is perhaps unusual about a cargo cycle is that it is deliberately designed to allow for multiple practices such as shopping, child-carrying and commuting in such a way as to allow trip-chaining, akin to the way in which a car is used. This flexibility in use, when added to identified advantages of cycling such as avoiding automobile congestion, and greater effective speed in the urban environment (Tranter, 2012; Walks & Tranter, 2015), leads Shove to suggest that 'the car is a type of bike' (n.d.: 1), a suggestion further examined in Chapter 9. This assertion emphasises the sharing of infrastructure, rules, and meanings, such as an association with freedom and flexibility, between practices of cycling and driving, and in the case of the hybridity of the cargo cycle, cargo capability. The sharing of elements between practices is further developed in Part B.

### 3.3.4 Changing practice

Shove and Pantzar (2005) argue that practices 'are always 'homegrown' … What looks like diffusion … [is] better understood as … successive, but necessarily localized (re)invention' (p. 43). The distinction between elements, seen as stable and capable of travel, and the less stable, non-travelling localized integration of practices, is important for the reproduction and diffusion of practices, and the roles consumers, producers, and institutions play in those processes (Shove & Pantzar, 2005; Shove et al., 2012). Shove and Walker (2010) claim that a strength of practice theory, in its conceptualisation of everyday practice transitions and innovation, is its ability to account for the horizontal circulation of elements at a meso-level.

Männistö-Funk (2011), in examining the 'home-grown' practice of self-made pedal cycles in rural Finland in the 40 years prior to World War I, is interested in the role of apparently marginal locations in technological development, arguing that these cycles represent home-grown rural handicrafts' engagement with modernisation, as both motivated self-makers and as a user group, rather than as clumsy imitators of factory made cycles and their user group. In her research, Männistö-Funk

incorporates Schatzki's (2001) direction to consider the motivations of practitioners, and Warde's (2005) suggestion of observing the commitment of practitioners to practices. Hobbyists have been shown to challenge dominant technological constructions creating through their expertise, innovation in practices (Franz, 2005; Haring, 2007; Männistö-Funk, 2011). Männistö-Funk describes rural Finland as being at this time 'a peripheral region in a peripheral country', and thus seen as a 'passive receiver' (p. 735) of technology, while her analysis points to a meeting point of local tradition and global innovation. She argues, that investigating the *use* of technology can challenge previous assumptions about the history of technology, and also its use and development in marginal places. She concludes that self-made cycles and their users in Finland were not interchangeable with factory made cycles and users, but were instead 'viable and understandable only inside the specific practices that had created them' (p. 754).

Practices change in a number of different ways (Shove et al., 2012; Watson, 2012), and this change is argued to be an emergent outcome of the (in)actions of all types of elements and practitioners, where all are internalised within the practice. Watson argues that there are three primary mechanisms for that change - change in the constitutive elements, change in the population of carriers, and change in the way practices are bundled together.

#### 3.3.4.1 Change in the constitutive elements of a practice

The exploration of change, as well as stability, is very important for understanding transport practices (Aldred & Jungnickel, 2014). In his examination of the practice of pedal cycle repair, Dowsett (2012) shows how, with regular performance, elements of a practice slip from view, only becoming evident again when they become non-functional, and disrupt the performance of the practice. His engagement, in common with many investigations (Warde, 2014), operates at the level of individual performance, accounting for the weakening of links (in terms of mechanical breakdown) between groups of common types of elements, such as the multiple materials which make up a pedal cycle, as well as the relationship between pedal cycle, mechanic, and workshop. Importantly, Dowsett makes the point that the pedal cycle, by its mechanical simplicity, remains repairable, even to inexperienced mechanics. This clearly contrasts with automobiles, where mechanical and computerised complexity renders them largely non-repairable, outside of specialist repair-shops (Franz, 2005).

As noted in Chapter 2, and further elaborated in Chapters 5, 6 and 8, the range of models of two and three wheeled cargo cycles available from different manufacturers varies between countries, many providing templates for self-building projects, so that the self-building process extends the range of coexisting cargo cycles within the practice of cargo-cycling (the range of material elements). This change in technology as an element in accomplishing a practice is perhaps the most obviously recognisable change in constitutive elements. However, changes in technology only have an impact on a practice if they are integrated into performance by practitioners (Watson, 2012). For instance, cycling using a three wheeled cycle requires some different competences to those needed to cycle using a two wheeled bicycle. If the required competency is not developed by the practitioner, a change in technology will not be incorporated into a practitioners practice. Equally, the distinctive performance of wearing "normal" clothes for cycling in Western cities with high cycling rates, sometimes termed velo-chic, has shifted meanings of cycling so that a "normal" look has become a legitimised design and style focus of cyclists seeking to emulate the European influence. Generally, though, change is incremental and co-evolutionary with change in one element reconfiguring inter-elemental linkages and thereby allowing further potential innovation (Shove & Pantzar, 2005; Watson, 2012).

#### 3.3.4.2 Change in the population of carriers

If new practices are to emerge and persist, they need to recruit practitioners as carriers. Which practices an individual is actually exposed to, and experience of particular practices, influences which practices an individual will have access to and can be recruited to, particularly if recruitment is discretionary, and alternatives are available (Shove & Pantzar, 2007). It is also clear that for new practices to gain carriers, other practices have to be abandoned (Shove & Walker, 2007). According to Reckwitz (2002), individuals are the 'unique crossing point of practices' (p. 256), sitting at the intersection of practices (Evans et al., 2012). Because practices have to compete with each other to fit into practitioners finite time resources, and the constraints imposed by spatial separation of activities (Røpke, 2009), for a practice to survive it must recruit practitioners at a rate at least equal to which practitioners defect. As Aldred and Jungnickel (2014) show, when a practice is widespread, it is just something that you do, acquiring a taken-for granted quality as exemplified by driving, or cycling in cities like Copenhagen and Amsterdam, where practitioners do no identify as 'cyclists'. In marginalising environments, identity as group affiliation, such as in claiming the descriptor 'cyclist', is more likely to take place.

In another examination of the recruitment of practitioners, Birtchnell (2012) in common with Mapes (2009: 37), uses the example of Gandhi seeing 'India producing its own cloth as a way to free itself from British domination' as a signpost as to how 'the bicycle could free urban centers from an over-reliance on cars'. Birtchnell argues that elements can be reconfigured and synchronised by elites (exemplary practitioners such as Gandhi), partly in response to significant events (such as public meetings where symbolic actions including in the Gandhi example making bonfires of foreign-made cloth) take place. The recruitment of practitioners is a focus of Chapters 6 and 7.

#### 3.3.4.3 Changes in relationships between practices – bundles and complexes

Another argument made by Shove (2009), is that practices shape or '*make* time', meaning that an individual's experience of time will be contingent on their performance of practices (Røpke, 2009). Pred's (1981) application of concepts from Hägerstrand's time geography emphasises the negotiation of a path through time and space which is reliant on the coming together and dispersal of elements and practices. On a daily basis, practices are grouped together as practitioners negotiate the organisation of their day and trip-chaining takes place (O'Fallon & Sullivan, 2009). Wood (2010), in arguing for a diffuse conception of the agency of cyclists, uses the term inhabit to refer to the totality of practices carried out by someone who cycles, 'including phenomena influenced by cycling but not solely experienced while cycling' (p. 1). This terminology reinforces understanding of cycling as part of multiple practices, such as shopping, commuting and leisure activities.

Within SPT, a distinction is made between bundles and complexes (Pantzar & Shove, 2010a). Minimally related but coexisting practices, such as those which are co-located are termed bundles. Meanwhile, co-dependence of practices, involving close relations or mutual dependency is described as the formation of a complex (Pantzar & Shove, 2010a; Røpke & Christensen, 2013). A practice based approach facilitates analysis of the bundling of, for example, mobility practices in space and time, with other practices with which they coexist and co-evolve (Watson, 2012). For instance, it is argued by advocates that cargo-cycling increases defection from the practice of driving, because cargo-cycling more easily coexists with the time and space constraints of the practices of shopping, commuting, and child transport than does conventional cycling. Additional benefits are also cited, due to the additional bundling of health and fitness practices.

In the same way that driving relies upon complexes of other practices such as vehicle sales, vehicle repair, fuel provision, transport planning, road building, and insurance, cargo-cycling relies on complexes of practices. These include cycle sales and repair, and overlapping with but also oppositional to the practice of road building, the practice of cycle lane and path construction. Thus, it can be seen that the dynamics of interrelations between and within practices can be both interdependent and competitive (Watson, 2012). The historical relationship between cycling and driving is inherently dynamic (Shove, 2014b). For instance, as it has become normalised to travel long distances to get to a place of work, cycling has been redefined from normal to abnormal, and convenient to inconvenient. A counter situation exists where congestion within the urban environment has further redefined cycling as quicker and more convenient than driving, a redefinition supported by Tranter and colleagues work on effective speed (Tranter, 2012; Walks & Tranter, 2015). Issues pertaining to the relationships between cycling and driving practices are further developed in Chapters 7, 8 and 9.

Changes to recruitment, defection, and constitutive elements are often exogenous to the practice. Watson (2012), argues that this is due to 'the shifting relative location of a practice within broader *systems of practice*' (p. 491), as seen in the relationship between automobility (Urry, 2004) and 'velomobility' (Koglin, 2014; Pesses, 2009; Walks, Siemiatycki, & Smith, 2015; Watson, 2012, 2013). This broader focus on the scaling of practices is one of a series of developments and debates within the practice turn related to both the potential coexistence of practice theories with other theoretical perspectives and future developments in the theorising and empirical application of practice theories.

### 3.3.5 Scaling practice

A systems of practice approach is broadly concerned with relations between practices (Shove, 2006b), and the extent to which the systems are exposed to ongoing reproduction (Shove & Walker, 2010). Researchers who are seeking to explicitly further the scaling of a practice theoretical approach, whether or not they invoke the systems terminology, argue for combining insights from theories of practice and other literatures.

Aldred and Jungnickel (2013), in their analysis of cycle parking strategies, combine practice theory with waste theory, to investigate how individuals are enrolled, object-

use is mandated, competences are accumulated, and related practices are performed. This approach is argued to reveal how environmentally and socially deleterious transport systems are maintained, reproduced, and sustained, despite public awareness of their problems. In exploring what they refer to as the 'secret lives' (p. 606) of objects, including pedal cycles, they reveal facets of the social ordering of systems, where competence is redistributed between people and things. They show how, in parallel with competence being increasingly distributed between drivers and cars, in terms of equipment such as in car navigation systems, responsibility for cycling safely is increasingly individualised. They also point to links between housing provision and transport practice within wider systems of living.

Birtchnell (2012) argues, that practice theory is capable of analysing large-scale socio-technical systems and transitions. Similarly, a number of authors see value in investigating the potential for crossover between socio-technical transitions theories and theories of practice (Hargreaves et al., 2013; McMeekin & Southerton, 2012; Watson, 2012), which are argued to offer complementary accounts (Warde, 2014). The multi-level perspective (MLP) first proposed by Rip and Kemp (1998) and most significantly developed by Geels (2011, 2012; Geels & Kemp, 2012) is seen to have particular potential in its proposition of a dynamic, non-linear relationship between niche, regime, and landscape levels in socio-technical transitions (Geels, 2011; Hargreaves et al., 2013). In this interactive relationship, niche innovations are understood to build internal momentum, while changes in the landscape bring the regime under pressure, and regime destabilisation generates opportunities for niche innovation (Geels & Schot, 2007; Shove & Walker, 2010). Related literatures such as strategic niche management (SNM), investigate the ability of niches to generate novel practices not seen within dominant regimes and the ability of those niches to bring change to the regime (Kemp, Schot, & Hoogma, 1998; Lovell, 2007; Schot & Geels, 2008; A. Smith & Raven, 2012). The grassroots innovations literature is particularly interested in the protective role of civil society in promoting and supporting sustainable niche developments, so that they bring change within the incumbent less sustainable regime (Hargreaves et al., 2011; Longhurst, 2012; Seyfang & Haxeltine, 2012; Seyfang & Smith, 2007; Smith, 2012)

While Birtchnell (2012) has addressed issues of scale in his discussion of the role of elements, elites, and events within practice theory, Watson claims that articulation of SPT with MLP overcomes both main criticisms of practice theory - accounting for

scale and change. Watson uses a transitions in systems of practice approach to recast socio-technical transitions, using the example of 'the troubled relations between driving and cycling – or between the systems of automobility and velomobility' (2012: 491). He questions why velomobility struggles in the face of the 'near relentless self-extension of automobility' (2012: 492), and asks how, as occurred in the past, sustainable modes can self-extend. Watson argues that a systems of practice approach facilitates a focus on actors' routinised actions throughout a system, including government, producers, innovators, the service sector, and users at regime as well as niche levels within the MLP. He tests these ideas by investigating issues of recruitment and defection to both cycle and car use (Shove, 2012), pointing to the constraints of finite practitioner time and money resources, competition for urban space, and competing discourses of for instance safety, health, environmental responsibility, convenience, and social status. A systems of practice approach is argued to be capable of identifying:

> intervention points which [can] initiate or give momentum to positive feedback processes, by which increases in recruitment to less carbon intensive practices of mobility, and in the defection from more carbon intensive practice [can] speed up (2012: 493).

Thus, Watson argues that three main gains can be achieved by invoking a systems of practice approach: 1) recognition of all the constitutive elements of a practice to broaden the range of interventions available to promote recruitment or defection, 2) recognition of the bundling of practices around mobility, allowing new points of intervention to be identified by responding to opportunities presented in shifting temporal and spatial interdependencies, and 3) from a systemic perspective, recognising where small interventions can initiate cumulative positive feedbacks in desired processes of recruitment and defection.

Amongst other examples of systemic transition via self-extension, Watson examines 'growing evidence of niches of innovation in practices around cycling … the proliferation of manifestations of the practice of cycling' (2012: 495) such as the emergence of cycling sub-cultures such as around 'fixies' (fixed gear cycles), 'velo-chic', electric cycles and cargo cycles. Watson (2013) reflects on the cargo cycle example, as one which overcomes the challenge of carrying 'stuff', thereby increasing the 'possible points of contact through which new practitioners can be recruited' (p. 127). In pointing to these examples of self-extension, Watson also highlights the parallel process of defection from competing practices via incremental normalisation through a series of thresholds or tipping points, so that system transitions occur

because of 'the practices which anchor those systems in daily life change' (2013: 118). In terms of policy-making, Watson argues that 'without parallel transitions in practices of governing manufacturing, investing, profit making and urban living' (2013: 129) systemic transitions in personal mobility will not occur. Many of those parallel transitions fall within the domain of policy intervention.

## 3.4 **Policy interventions**

As already made clear, practice theories are positioned between the extremes of the structure-agency dualism. Such positioning has in the past seen robust debate between, on the one hand, advocates of behaviour change initiatives and practice theorists (Shove, 2010a, 2011b; Whitmarsh, O'Neill, & Lorenzoni, 2011), and on the other hand, between Shove and Walker (2007, 2008) and advocates of transitions *management* from STS (Rotmans & Kemp, 2008). Warde (2014), remarks that one of the criticisms made of practice theory is the difficulty of applying it to policy. This may account for Shove et al.'s (2012) contention that policy development has, thus far been little influenced by theories of practice. However, if as Warde suggests 'the source of changed behaviour lies in the development of practices' (2005: 140), then understanding the emergence, persistence, and disappearance of social practices will have important implications for understandings of consumption patterns, infrastructure development, institutional change, and the promotion of sustainability.

A recent edited book, *Social Practices, Intervention and Sustainability: Beyond Behaviour Change* (Strengers & Maller, 2014) asks contributors to consider:

- Can we intervene in, or govern, social life from a social practices theoretical perspective (rather than behavioural or other perspectives)?
- How do/can we intervene in, or govern, social life from a practice theoretical perspective? And what are the possible outcomes and benefits for sustainability?
- How can we predict or anticipate the outcomes of intervening in practices if they are inherently dynamic and uncontrollable? (Shove, 2014a: 32)

Shove, in her response claims these questions imply a 'narrow interpretation of policy relevance' (p. 32) and foreground too much the assumed predictability of policy interventions, and the agency of those designing such interventions, ideas potentially at odds with viewing the world through a practice theoretical lens. Shove (2014b) contends that the forms and opportunities for policy intervention are emergent facets

of the pre-existing system that policy makers seek to impact upon, and consequently can produce unpredictable feedback loops.

Such concerns have not prevented attempts to 'use' practice theory too 'inform and instigate social change' (Strengers, Moloney, Maller, & Horne, 2014: 63). For instance, there have been attempts to apply practice theory retrospectively to the successes and failures of programmes designed to influence behaviour, in order to evaluate alternative means of delivering desired outcomes (see for example Evans et al., 2012; Hargreaves, 2011; Maller, Horne, & Dalton, 2012). Attempts have been made to redirect and reframe pre-existing behaviour change programmes towards 'social (practice) change programmes' (Strengers et al., 2014: 64). Ultimately rejecting the idea of acting as agents moving programmes along a theoretical continuum towards a practice theoretical perspective, Strengers et al. conclude that it is more productive to act as 'agitators of practice, circulators of elements, and recruiters of new practice carriers' (p. 74).

Spurling and colleagues (see Spurling & McMeekin, 2014; Spurling et al., 2013) have paid particular attention to developing practice theory and policy linkages. In so doing, they have primarily reviewed existing policy interventions from a practice perspective to both identify where practice theory-informed ideas are already present in policy, and to think about how policy might look if it was informed, redirected, or reframed by this perspective. Essentially, such a process involves critiquing the identification and use of what counts as evidence (Cartwright, 2010; Cartwright & Hardie, 2012), in existing policy framings, where 'groups are constrained by fixed ways of thinking and interacting … [thus finding it] difficult to bring about changes that fall outside the scope of … [a] particular way of thinking' (Hommels, 2005: 331). To this policy mix, it is argued that different measures will be required to engender change, depending on the availability of the requisite elements. For instance, as Shove (2012, 2014b) illustrates, the conditions for the revitalisation of cycling in the Netherlands and the UK, have been quite different. Although in both countries, cycling had, by the mid-1970s declined rapidly, de la Bruhèze (2000) argues that despite the linkages being broken, the requisite elements were still present in the Netherlands, whereas in the UK 'bicycle use had declined too far … [and the] material and social bicycle culture has disappeared' (p. 4). Consequently, different types of policy interventions were, and will be, required in different countries.

This conclusion resonates with Cartwright and Hardie's (2012) view on evidence based policy, that what work's in one location, will not necessarily work in another, because as they put it, the difference between, worked, work, and will work is 'not just a matter of grammatical detail' (p. ix). In the Netherlands, elements of the cycling regime of the first half of the twentieth century continued to exist in terms of skills, conventions, and habits, as well as continued residual public policy commitment to cycling as a mode of transport. Shove (2012) states that it is useful to think about the obduracy of cycling as 'stickiness or durability', as in for instance the face of automobility, resurrecting cycling may be a question of searching for 'pockets of persistence' rather than 'niches of innovation' (2012: 372), where fossils may be re-activated or reincorporated (Shove & Pantzar, 2006). As a consequence, overcoming path-dependencies may have a temporal component based upon when those paths were dug (Shove, 2012).

In considering the operationalisation of such resurrections, Spurling and colleagues review a number of mobility policy interventions from the UK (Spurling & McMeekin, 2014; Spurling et al., 2013). Spurling and colleagues give examples of existing cycling policy interventions which they suggest are consistent with the three re-framings of policy consistent with a practice theoretical focus: recrafting, substitution and interlocking. Recrafting practices is based upon intentionally recrafting the elements which form a practice such as the introduction of low-emission, energy efficient vehicles to driving practice. Recrafting a cycling practice might include the provision of a bike library [15] so that people can borrow pedal cycles for short or extended periods to accomplish specific tasks and/or work out whether a particular design of pedal cycle meets their longer-term needs. Spurling and McMeekin give the example of a Birmingham-based pedal cycle project, which combines lending-out pedal cycles, with designing new cycle routes, providing showers, storage and maintenance facilities at 'cycle hubs', and the provision of cycle maintenance classes. Together, these initiatives are argued to help re-craft, with the intention of growing, the practice of cycling in Birmingham.

Policies which encourage substitution of practices discourage one practice while favouring another, a process of negotiating the accomplishment of needs and wants,

[15] Bicycle libraries are a form of medium- to long-term bicycle share often run by non-for-profit organisations where bicycles are loaned either free of charge or for a refundable deposit. The libraries facilitate regular bike use and testing of the suitability of alternative bicycle designs.

such as achieving shopping by pedal cycle rather than driving. This might be achieved for example, by changing some of the elements of cycling, such as borrowing a cargo cycle from a bike library to find out whether it is a viable option, and subsequently building or purchasing a cargo cycle to fulfill specific load-carrying need. Another approach which favours cycling, and also includes restrictions on car-use, forms part of Pucher and Buehler's (2008b) prescription for making cycling 'irresistible'. Spurling and McMeekin (2014) claim that one of the advantages of this form of intervention is that it is more directed than a vague policy aim of generating modal shift.

The third re-framing is more far-reaching, being aimed at the interlocking of practices which generate an overarching need for mobility, seeking to re-negotiate that need or demand. This idea challenges the system of automobility, by directly confronting, for instance, the road building focus still evident in New Zealand, where current strategic road construction projects are reminiscent of the 'later stages of the "predict and provide" era in the UK' (Lyons & Goodwin, 2014: 3). In going beyond the remapping of the space between places of practice performance, such as in compact urban development, this form of re-framing envisages that 'new spaces might be developed to cater to new forms of interlocking' (Spurling & McMeekin, 2014: 89). One such example is the increase in online shopping where retailers deliver goods, rather than individual purchasers collecting them. As is made clear by Spurling and McMeekin, there are still questions to be answered regarding the sustainability credentials of such services, but as discussed in Chapter 2, this kind of initiative is one where cargo cycles, and other less carbon-intensive modes, can effectively be incorporated.

While all three re-framings seek to grow what are considered to be desirable practices, they present a form of hierarchy where changing how practices interlock becomes the highest level of aspiration which, in the case of mobility interventions operate 'within the wider system of practices which produces the need for mobility' (Spurling & McMeekin, 2014: 88), foregrounding the 'negotiability of need' (Shove, 2003a; Strengers, 2011).

Having reviewed the core relevant ideas concerning the application of practice theory to this thesis, and recent scholarship on urban cycling which makes use of practice

theory, I now point to some of the interim conclusions which can be drawn from this analysis.

## 3.5 Concluding remarks

There are clear indications, from the literature reviewed in this chapter, of the value of making use of a practice theoretical lens when conducting studies of cycle-based urban mobility. It is clear from recent contributions to practice theory, that it offers a theoretical approach, that while not entirely unified, allows an alternative perspective to the dominant theoretical perspectives commonly applied to social theory and policy development. Rather than just seeking to identify barriers to change, practice theory seeks to conduct a 'rigorous science of practice … [asking] what are the conditions which make such knowledge possible' (Bourdieu, 1977: 4), taking practical, tacit knowledge seriously as part of the 'conditions of possibility' (Nettleton & Green, 2014: 250).

A practice based approach decentres the individual and individual choices, focusing instead on the convergence of elements seen in performances of practices (Shove, 2003a; Shove et al., 2012; Watson, 2012). Theories of practice move beyond what Schatzki (2002: 60) calls the 'mythical allure of context', by analysing how elements of practice mix in dynamic relationships, configuring spatial and temporal scales (Hitchings, 2011), rather than being reducible to individual behaviour based upon attitudes and choices (Watson, 2012).

Stakeholders beyond 'users' of transport systems, such as the transport industry, retailers and advertising companies, the media, lobby groups, employers, and non-transport government agencies must all be accounted for when designing low-carbon mobility policy interventions (Schwanen, Banister, & Anable, 2012). Further, as Røpke (2009) points out, issues such as gendered and unequal access to resources, and political, legal, economic and cultural institutions all play a part in constituting practices as entities and performances and the sharing of elements between practices. Dominant psychological accounts of behaviour change obscure the social and environmental dimensions of practices (Schwanen et al., 2012). Further, more recent "soft" or libertarian paternalist policies, as reflected in so called "nudge" policies (Thaler & Sunstein, 2008; Warde, 2011), have the potential to perpetuate existing inequalities (Pykett, 2012), and the gendering of travel practices (Schwanen et al., 2012: 530). Extending analysis to issues of unequal access to resources, such

as the gendering of travel practices, and opportunities for people on low incomes to afford to decarbonise their mobility practices begins to address practice theories lack of attention to the perpetuation of inequality, social justice, and equity (Walker, 2013).

Subsequent chapters apply SPT to both cycle-based urban mobility practices and the intersection between those practices and activities such as shopping and child transportation and to the relationship between cycling and driving practices. Cargo-cycling is a practice-variant of what Watson (2012:495) calls the 'proliferation of manifestations of the practice of cycling'.

# Chapter 4 Research strategy and design

## 4.1 Introduction

A range of policies will be required to support decarbonisation of the transport sector. In their critical review of research into climate mitigation in transport, Schwanen, Banister, and Anable (2011) summarise research focused on the decarbonisation of transport as emphasising:

> mitigation via technology, economic instruments and infrastructure provision, and to a lesser degree on reconfigurations of travellers' psyche through information campaigns and social marketing and the institutional arrangement of transport governance. Insights from engineering, (neo-classical) economics and to a lesser degree psychology prevail and most research is predicated on the use of quantitative methods embedded in positivist epistemological frameworks. This pattern is the consequence of mutually reinforcing trends … within and especially outside academia, where green governmentality and ecological modernisation constitute the main frameworks for talking climate change mitigation (p. 1002).

While such approaches are manifestly insightful, they are nevertheless 'inevitably partial' (p. 1002). Perhaps one reason for the prevalence of this positivist framework lies in the use of the terms transport and/or transportation, which tend to imply that people are objects to be moved with speed and efficiency (Illich, 1974; Vivanco, 2013b). Such an implication tends to underplay the multiple material and cultural factors, and personal competences which enable or constrain daily mobility. Schwanen and colleagues, see at least three benefits in making use of social science traditions in understanding transport based climate change mitigation, including 1) furthering understanding on the basis of multiple 'context-dependent social processes', 2) increasing the pool of potential research methods, and 3) allowing the formulation of different research questions. In short, such an approach allows a turning around of research problems (Bacchi, 1999, 2009, 2012; Bletsas & Beasley, 2012; Shapiro, 2002).

The practice turn in the social sciences centres the analysis of practices, thus subordinating individual practitioners to the practice itself (Pink, 2012), denying the reducibility of people's behaviours to individual attitudes and choices (Shove, 2010a; Watson, 2012). Rather than using a practice as a constant, and seeking to understand who does it and why, practice based research asks how practices are made and reproduced by those who do them, making practices, not practitioners the unit of analysis (Shove & Pantzar, 2007). This centre-staging means there is no 'well-defined package of research designs and no ready-made repertoire of methodological

tools ready and waiting for the practice-based researcher to pick up and deploy' (Harvey, McMeekin, Shove, Southerton, & Walker, 2012: 3). Indeed, Warde (2005) calls for an openness to 'breadth in method and techniques of interpretation' (p. 149) to allow for the interpolation of shared meanings and the distribution of practices (Harvey et al., 2012). Thus far, 'methodological issues in applying practice theory in empirical research … have … only been sparingly dealt with in the literature' (Halkier & Jensen, 2011: 117).

The methodological advantages of practice theory, lie partly in the fact that practices are directly observable, as visible features of everyday life. Practice performances allow for 'generalised understandings', and for conclusions to be drawn concerning the fabric of social life (Everts & Jackson, 2009: 922). The research design takes heed of Nicolini's (2009b) suggestion, originally devised to study the organisation of work through ethnographic appreciation of practice, to adopt a theory/methods package which zooms in and out 'on the data and between data and theory' (p. 120), between practice performance and practice entities as they coexist in space and time, until a coherent picture emerges. Such an approach, conceives of the taking up of practices in different temporal and spatial locations, as a process of reinvention rather than diffusion (Shove & Pantzar, 2005). Zooming-in therefore, allows attention to focus on the competences necessary to perform a practice, centring the performance, and subtle changes between performances in a particular location in time and space. It also allows scrutiny of the relationships between elements of the practice, such as between practitioners, materials, tools, and competence, and the normative images of rules and norms. Zooming-in also shows where practices rely on alternative/complementary practices, and conversely, that one practice constitutes the resources for another practice (Nicolini, 2009b). Zooming-out focuses on the practice entities, and how they form bundles and complexes with other practices, within circuits of reproduction.

As Warde (2014) makes clear, zooming-in on individual performances of practices has dominated recent practice-theoretical accounts, while zooming-out to attend to practices entities and the intermingling of many practices is a 'daunting prospect' (p. 296). Here, I seek to account for cargo-cycling as a competing and overlapping practice-variant of cycling, which has the potential to meet need for load-carrying in urban environments. By zooming-in and –out, I develop an elaboration of the conceptual framework of SPT, which builds upon Nicolini's (2009b) ideas of

proceeding rhizomatically, but takes them in a slightly different direction. I conceptualise the intermingling of practices as a schematic diagram of an integrated an interconnected network, similar to the wires and connectors of an integrated electrical circuit diagram. This choice to use a topological map or schematic diagram, such as the London Underground "map" first designed by Harry Beck, and produced by TfL, is based upon its value in conveying interconnectedness rather than physical arrangements, incorporating visual simplicity, colour coding, and symbols (Garland, 1994). The systematic application of the development of this conceptualisation is summarised in Part B, at the end of each empirical chapter.

## 4.2 **Ethical considerations**

This research took place, following assessment by the University of Canterbury Human Ethics Committee of the proposed research as low risk (Appendix A). Those who expressed an interest in participating were sent an information sheet (Appendix B and C) and consent form (Appendix D). Participants in the QM study were also sent a pack which incorporated Q sort instructions (Appendix E). Consent was given on the basis of confidentiality, as anonymity within such a small community of interest could not be guaranteed, even though participant names are not used.

## 4.3 **Fieldwork**

Fieldwork produces situated knowledge insights, that are local in time and space (Johannisson, 2011), a zooming-in on localised performances of practices. The fieldwork conducted for this thesis must, therefore, be seen in relation to the zooming-out to the wider landscape of inter-relationships between practices. The fieldwork was conducted in stages between 2011 and 2015, as a means of investigating the situated performances of load-carrying for cycle-based urban mobility, and specifically how cargo bikes are incorporated into those performances, and how those localised performances relate to the achievement of the routines of daily life in urban environments.

Tracing load-carrying cycle-based urban mobility practices took me to four sites, Christchurch, Palmerston North and Wellington in New Zealand, and Portland in the US state of Oregon (Table 2). The rationale for this choice is as follows:

**Table 2 Core city data from census data**

| City | Christchurch* | Palmerston North* | Portland (city)^ |
|---|---|---|---|
| Population | 341,469 | 80,079 | 605,568 |
| Urban area ($km^2$) | 608 | 326 | 376 |
| Urban density (per $km^2$) | 562 | 245 | 1602 |
| Cycling mode split | 6.8%(*n*1791) | 5.7%(*n*9804) | 6% |

Note: * Census 2013 (Statistics New Zealand, 2014-a, 2014-b); ^ United States Census Bureau, 2016)

- Christchurch and Palmerston North have, in recent years, vied for the status of the cycling capital of New Zealand, in terms of main means of travel to work data, collected by Statistics New Zealand for the five yearly Census of Population and Dwellings[16]. As a consequence, these two cities were chosen for the exploratory Q methodology (QM) study reported in Chapter 5.
- It became clear, in recruiting participants for the QM study, that there was probably only one purpose designed cargo bike in use in Palmerston North at that time (2011/2012). Seeking to specifically research practices incorporating the use of cargo bikes necessitated an alternative location. Interviews with the handful of people who had some involvement in the early importation and selling of cargo bikes in New Zealand, all at that time (pre-2014) based in the greater Wellington region, made it clear that Christchurch was a likely place to generate cargo-cycling research participants.
- This likelihood, coupled with my move to Christchurch in 2011, presented a pragmatic opportunity to both interview cargo-cycling practitioners, and become a participant observer of load-carrying cycling practices in Christchurch.
- The award of a Claude McCarthy fellowship allowed me to spend two weeks in Portland, as my final fieldwork location. Portland was chosen, based on several similarities in terms of cycling participation when compared with Christchurch, and at the time of my visit in June 2012, it being the self-proclaimed cargo-cycling capital of the US. As shown in Chapter 7, Portland has another similarity to Christchurch, which lies in the potential for both cities to be affected by significant earthquake events. My visit to Portland coincided with a 3 week festival of cycling which incorporated the first cargo bike agility trial – the Disaster Relief Trials (DRT) - devised to showcase cargo

[16] The Census scheduled for 2011 was delayed until 2013 in response to the disruption caused by the 2011 Christchurch earthquakes.

bike versatility in a post-earthquake scenario, analysed in Chapter 7. Portland, therefore, afforded me the opportunity to:

a. Be a participant observer of cycling in the city.
b. Be a non-participant observer of cargo-cycling in the city.
c. Conduct in situ interviews, and make contacts in preparation for later Skype-based interviews with the organisers of the DRT.

In summary, to generate these accounts people already engaging in cycle-based urban mobility practices were interviewed or asked to participate in the QM study. The QM study participants were recruited from the cities of Palmerston North and Christchurch. The other participants were recruited from Christchurch and Portland and in the case of cargo cycle retailers in New Zealand, from the Wellington region where all the early retailers were located. All participants were purposively criterion sampled (Palys, 2008) for respectively their load-carrying, cargo-cycling and retailing experience. In total 46 participants took part in the research, all involved in load-carrying cycle-based urban mobility. They are variously people who carry loads on pedal cycles in the domestic and commercial realm, cycle retailers, activists, academics, home-builders of cargo bikes, drivers, parents, single people, couples, male and female and vary in age from their late twenties to late seventies.

## 4.4 **Research methods**

Conceptualising the challenges of decarbonising mobility, in terms of the dynamics of social practices, has ramifications for methodology, and empirical investigation. The literature shows that the methods chosen to conduct studies of social practices are as potentially diverse as the theoretical influences (Shove et al., 2012). Warde (2005: 149) sees a need 'for breadth in method' to conduct research inspired by theories of practice, while Geels (2011) anticipates productive disagreement over methodology, in researching complex and multifaceted research topics. In contrast to behavioural research, there is no 'well-defined package of research designs and no ready-made repertoire of methodological tools ready and waiting for the practice-based researcher to pick up and deploy' (Harvey et al., 2012: 3). Nicolini (2009a, 2009b, 2012), advocates a pragmatic eclecticism, which fits with the heterogeneous, connective and constructive ontology, and socio-material, non-individualist epistemology of practice theory, to understand how social order and change is achieved (Huizing & Cavanagh, 2011). According to Uteng and Cresswell (2008), 'real' travel stories emphasise the complex ways gender and mobilities intersect,

given that 'both concepts are infused with meaning, power and contested understandings', and go some way to preventing mobility from becoming an 'elusive theoretical, social, technical and political construct' irrevocably tied to consumption (p. 1).

Interpretation of practices necessarily requires methodologies capable of investigating shared meanings, the scalar distribution of practices, and the 'dynamic and recursive processes' of stasis and change (Harvey et al., 2012: 4). This then is problem representation (Bacchi, 2009) driven research, focused more on what matters than which method (Schram, 2012; Shapiro, 2002). This research draws upon mainly qualitative methods but also incorporates a 'qualiquantological' (Stenner, Watts, & Worrell, 2009) multi-participant QM study which gathers data in the form of Q sorts, which are then subjected to inter-correlation and factor analysis. The resulting factors are interpreted to a high level of qualitative detail (Watts & Stenner, 2012), making QM a 'typically qualitative and a very critical method' (Watts & Stenner, 2005: 70). This research also draws on a combination of comparative, historical, and secondary analysis, interviews about practices, and what Pink (2012: 40) calls 'the engaged study of practices as they are performed': engaged participant observation. Comparative analysis seeks to show how practices-as-entities vary and at the same time mould practice performances across cultural space and time. The practice–variant of cargo-cycling can be easily recognised as a variation of the practice-entity cycling, but also as a variant of load-carrying practices, normalised in many locations as being achieved by driving, but less readily understood outside of specific sites of practice, such as Copenhagen. Thus, in understanding how practices recruit and travel, the methods have been chosen to be capable of ascertaining who participates, how they find out about the practice, and how practices change over time (Harvey et al., 2012). Further, understanding how localised practice performances relate to each other ,and to an evolving practice entity, places more demands on method selection.

To achieve these multiple aims, this research adopts a range of strategies and methods consistent with a practice theoretical epistemology:

1. The ethnographic methods of in-depth interviewing and participant observation were adopted as 'a useful way in to practices' (Harvey et al., 2012: 9). Combining participant and non-participant observation with interviewing helps to overcome any limitations of either method (Hitchings, 2012), and

focus on practice-as-performance assists in the analysis of stasis and change (Pink, 2012) in the reproduction of practices, allowing analysis of temporal and spatial scales. As well as interviewing cargo-cycling practitioners, intermediaries involved in the construction and sale of cargo bikes and cycle advocacy were also interviewed, to draw a wider picture of how cargo-bikes are conceptualised, sold, and used.

2. The combining of interviews with other methods is seen to enhance data collection veracity (de Vet, 2013; Halkier & Jensen, 2011), particularly where alternative methods are then used as inputs into interviews, as well as original data (Halkier & Jensen, 2011). For part of this study, the data collected from interviews is enhanced by combining it with an innovative application of the research technique, QM, which inverts traditional R methodological statistical techniques, by employing participants as variables (Watts & Stenner, 2012) and, in this research, practices as variables. To interpret the practices meanings shared by practice-collectivities, QM is used to identify the pattern of practice-variants of cycle-based load-carrying observable in a group of cyclists from the two cities in New Zealand, which have in the recent past vied for pre-eminent status for cycling mode share. Such an approach represents a new step in researching practices, which frequently rely on purely qualitative data, or analysis of pre-existing data sets (Pullinger, Browne, Anderson, & Medd, 2013), to capture the diversity of load-carrying cycling practices.

Specifically, the research incorporates:

1. Participant and non-participant observation at cargo-cycling events and of cargo-cycling practices in Christchurch and Portland, the Portland observation specifically focusing on a cargo cycle event, the Disaster Relief Trials.
2. QM studies with 20 New Zealand participants, followed by inter-correlation and factor analysis.
3. Follow-up semi-structured interviews with the 20 QM study participants.
4. Semi-structured interviews with 26 cycling activists, cycle builders and retailers, and cycle couriers, in Christchurch, Wellington and Portland (Appendix F).
5. Review and analysis of historical and secondary sources, including news media reports of cargo-cycling.

Combining these methods allowed me to follow things in motion, collecting complementary forms of data, not by using mobile methods, but by using

'observations, interviews, and other traces to capture the complex mobilities of the case' (Hui, 2012: 201; Larsen, Urry, & Axhausen, 2006). According to Babbie (2004: 307) '"being there" is a powerful technique for gaining insight' which greatly strengthens the validity of field research, by tapping depths of meaning. My purpose is to understand cargo-cycling as a load-carrying practice – a practice which is about getting things done. Rather than trying to make statistical generalisations, small size qualitative studies can make theorised claims about the patterns and dynamics of the material, an analytical generalisation, where results are 'made more general by becoming valid for categories related to social scientific concepts, due to the theoretical relevance of the sample (Halkier & Jensen, 2011: 113).

## 4.5 **Data analysis**

The data analysis reflects the data collection techniques employed. The data analysis for the Q sort conducted as part of the application of QM is described in detail in Chapter 5. The interviews conducted as part of a QM study, and the interviews conducted specifically with cargo-cycling practitioners, were analysed against a framework bounded by the observation of the enacting of cargo-cycling practices, and the relationship of those practices to the doing of daily life for the participants. The data analysis, therefore, reports the views and culture of the participants in condensed form, in an attempt to formulate what the participants mean and understand, in the context of the critical evolving understanding gained by the researcher of the wider arena of practice (Spencer, Ritchie, & O'Connor, 2003).

Data analysis was conducted in three broad, iterative, interwoven stages, comprising data condensation, display, and conclusion drawing. The voluminous nature of the collected data comprising Q sort data, transcripts of interviews, field-notes, documents and photographs, made data reduction a crucial task, accomplished here by thematic summaries of participant and observational accounts (Miles, Huberman & Saldana, 2014; Spencer et al., 2003). Condensation involved organisation, coding and summarising, and theme development, to sharpen, sort, focus, discard, and organise data, to facilitate the drawing and verification of conclusions (Miles et al., 2014: 12). Data display involved construction, and ongoing refinement (Figure 4-1) and review of mind-map-type visualisations (Guest, MacQueen & Namey, 2012) and schematic diagrams, and conclusion drawing was based upon reflexive examination of initial conclusions, on the basis of ongoing data review. The coding process, involved placing raw data into valid, mutually exclusive and exhaustive categories,

comprising a mixture of words, phrases, sentences, paragraphs, reflections, and images (Miles et al., 2014). These codes were analysed for patterns, and contradictions to avoid confirmation bias.

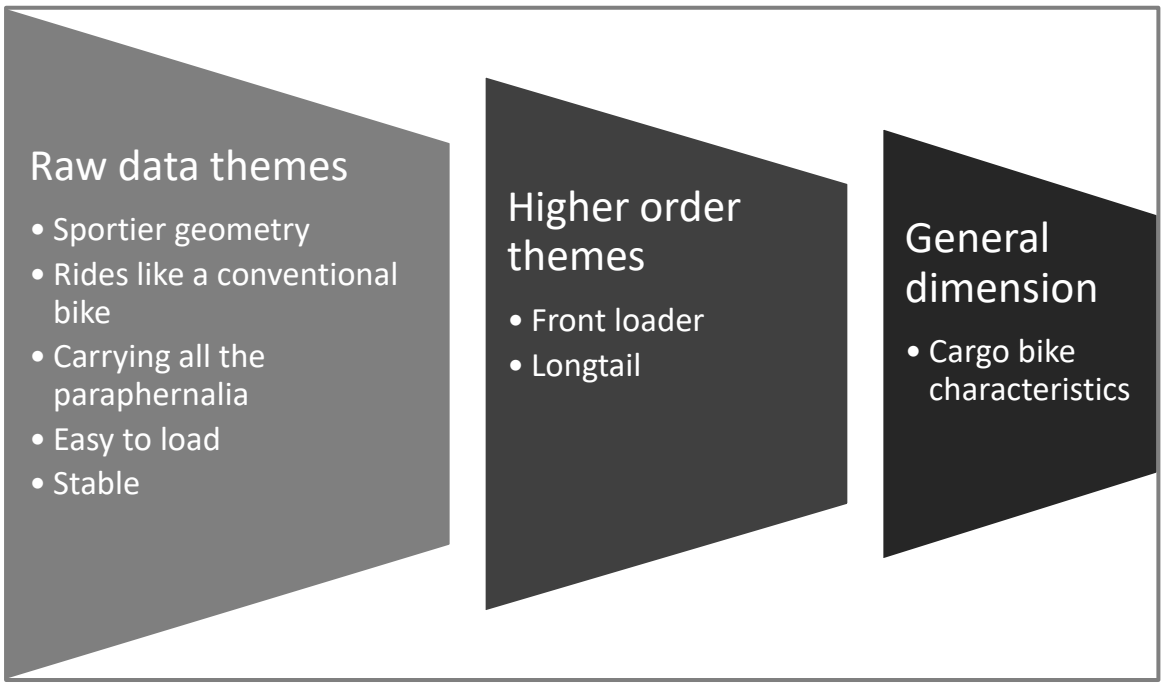



**Figure 4-1 Data reduction theme exemplar**

## 4.6 **Positionality**

One of the participants in this research refers to people who might be interested in cargo bikes, but who have not (yet) become cargo-cyclists, as the 'cargo curious' (PO7). This is an apt description of my position at the beginning of this research. I came to this research as a walker, car and truck driver, cyclists, public transport user, and general transporter of things (but not children), in the course of my daily life. I share these characteristics, and in the case of the Christchurch participants, experience of living through the 2011 earthquake events, with many of the participants in this research. As it turned out, this experience presented a commonality with the Portland participants, in the sense that the organisation of the DRT was based upon a disaster preparedness scenario. My position is therefore as an insider and an outsider.

Semi-structured interviews produce knowledge via interaction between the researcher and the participants, which is then subject to interpretation by the researcher, in the light of the extant literature. As is emphasised in practice theory,

in the same way as policy makers and interventions are part of policy and practice 'occurring within and not outside … locally specific histories' (Shove, 2014b: 424), the researcher also becomes part of the practice they are investigating.

## 4.7 **Practices as a unit of analysis**

Building on earlier work on situated, context specific and more general approaches to analysing practices, this thesis elaborates upon the conceptual framework of practice theory, as expressed in the analytical simplification of SPT. This elaboration seeks to combine the benefits of the analytical simplification of SPT, evident in the three elements diagram (section 3.3.2 and Figure 3-3). The study of practices aims to obtain an overview of the three elements and the way they relate to each other, 'the fleshing out of the model' (Kuijer, 2014: 52). Here I flesh out that model in diagrammatic terms, by proposing my first adjustment to the approach advanced by Shove and colleagues, by integrating and developing zooming techniques, to further develop focus on the dynamics of practice. The first building block of that adjustment, following Shove and colleagues tripartite practice schema, is based on the conventional three core electrical cable, to represent the three analytical elements of practice theory - materials, competence, and meaning (Figure 4-2). This representation focuses on load-carrying practices as whole entities, which have dynamic relationships with coexisting practices in space and time, acting as a visual and analytical tool to account for the configuration of practices as experienced by practitioners. The decision to hand draw this, and the subsequent schematic representations developed in this thesis, is premised upon emphasising the fluidity of practice relationships.

This visual schematic of the three core cable, emphasises the coming together of the elements of practice necessary for performance, but at the same the ideal-type practice entity template filled out by individual performances. Further, the multiple strands within each core emphasis the multiplicity of competences, images, and materials present in an entity, to be drawn upon for performance of that entity.

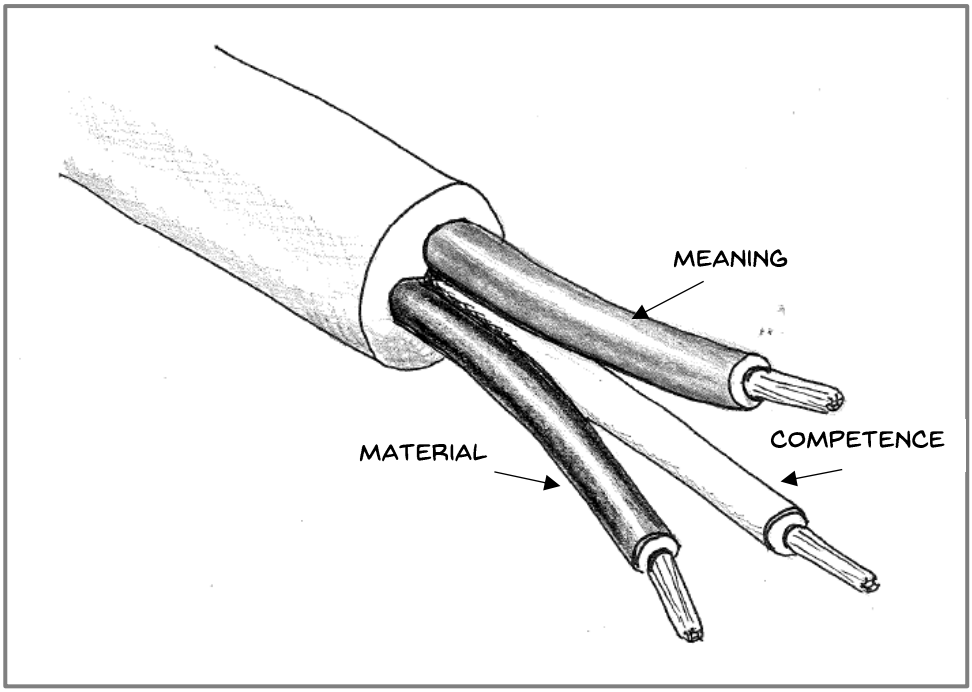



**Figure 4-2 The 3 elements coalescing in a practice entity**

## 4.8 **Concluding comments**

Research underlined by a practice theoretical perspective allows for a breadth, but also some level of innovation in methods. The research design described in this chapter enables examination of cycle-based load-carrying practices and their intersections with other routine practices in the accomplishment of everyday life. Examination of the doing of urban mobility practices advances the central aim of this research, to move beyond polarised problem representations of cycling as individual choice or structural constraints. Part B, in zooming-in on aspects of load-carrying practices, advances understanding of load-carrying by drawing on the interview, observational and QM data collected during the course of this research. In so doing key aspects of cargo-cycling practice relationships are brought into sharp focus.

# Part B – Accounting for load-carrying - zooming-in on load-carrying practices

The thesis section presents five empirical chapters. Recent practice-theoretical accounts have tended to analyse individual performances of practices, and pay less attention to practices-as-entities (Warde, 2014). The next five chapters seek to account for cargo-cycling as a competing and overlapping practice-variant of cycling which has the potential to meet need for load-carrying in urban environments, an account which even Warde concedes to be a 'daunting prospect' (p. 296). However, such an account is argued by Warde to present what he calls a strong theory of practice by insisting that 'structural characteristics are nothing more than the intermingling of many practices … the object of macro-level analysis' (p. 295). The following chapters play close attention to multiple localised performances of cargo-cycling as a practice-variant of cycling as an entity. In so doing, considerable attention is given to practice bundling and overlap in space and time - the rhythms of load-carrying practices that cargo-cycling coexists and intermingles with. Conceptualising practices as either practices-as-performances which reveal understandings and meanings of practices carried by practitioners, or practices-as-entities where the intent is to identify and define practices distributed across space and time, has implications for method selection. For instance steering, braking, gear changing, pedalling, and observing are all recognisable elements of the practice-as-entity of cycling. But are these elements so standard and accommodating of internal variety that they apply to the performances of mountain bike racing and urban mobility cycling, cycling in for instance 1956 and 2016, and cycling in Copenhagen, Portland, and Christchurch, despite variations in meaning, technique, infrastructure, and equipment? Harvey et al. (2012: 7) make the point that viewing and defining practices as 'provisional but … recognisable' allows identification of practice recruitment, reproduction, and change across space and time.

As noted in Chapter 3 placing practices, not individuals or infrastructures, at the centre of analysis, reframes research questions to ask how practices rather than individuals can become, for instance, more sustainable (Spurling et al., 2013). Investigations, such as of contemporary travel patterns, become a question of asking which practices people participate in, and how they order and organise practices rather than what individuals choose to do.

In Part B, chapters zoom in or out on load-carrying cycling practices, drawing on empirical case studies and examples from New Zealand and Portland in the US State of Oregon. The chapters move between SPTs more usual focus on the everyday to engage with practice coexistence, collaboration, competition, and change. Together these five chapters represent a series of snapshots, which both contribute to the whole thesis argument but also stand on their own as individual investigations. Those investigations reinforce the status of cargo-cycling as both a nexus of load-carrying practices and as a crossing point of diverse and complex day-to-day, academic, activist, cultural and policy–making practices (Cox, 2015a). These chapters, in zooming-in on specific practice configurations, effectively magnify 'aspects of common social processes which generate observable patterns' (Warde, 2014: 279). Each chapter visits a different site of the dynamic relationships between and within practices contributing to the overall network of load-carrying practices examined in this thesis. Thus, during the course of the thesis, the arguments advanced gradually fill out portions of the structure of the network, as a representation of the knowledge gained. This is achieved by concluding each empirical chapter with a visual representation of the practice dynamics zoomed-in upon in that chapter in the form of a practice summary, extending the visual schematic outlined in Chapter 4. Later, in Part C these individual representations of the zooming-in process are drawn together as the thesis zooms out to the broader viewpoint of the thesis in its entirety, with the aspects of the overall network examined in the empirical chapters situated within that wider network of load-carrying practices.

Chapters 5 and 6 concentrate on the local doings of load-carrying cycling practices in New Zealand, focusing on the integration of the materiality of cargo bikes into local performance. This preoccupation is a traditional strength of practice theories which are accepted, even by critics as being well placed to examine the complexities of the local integration of elements into the details of doing (Watson, 2012). In the spirit of SPT, and influenced by Bacchi's injunction to question take for granted assumptions, these chapters question how it is possible for something to happen rather than why.

In Chapter 5 the practice gaze is directed towards pedal cycle-based load carrying practices of established cyclists in Christchurch and Palmerston North. This zooming-in is achieved by the application of QM. The outcomes of Chapter 5 are

therefore two-fold. Firstly, zooming-in on load-carrying in these two cities, which have both at different times achieved cycling capital of New Zealand status, identifies the bifurcation or diversification (Watson, 2012) of load-carrying into practice-variants, analysed in QM terms as factors. This zooming-in interrogates what Cox (2015a: 1) calls the 'bland singularity' of the term cycling which glosses over the range of practices held within that term. Secondly, by combining a QM technique of investigation with a practice theoretical perspective study this chapter broadens the application of both QM and practice theory, in an investigation of the potential of combining the explanatory potential of both. An earlier version of this chapter was presented at the Velocity 2012 conference in Vancouver, Canada (Pearce, 2012). Following communication with the editor, the current version is in preparation for submission to the journal Geoforum.

Chapter 6 investigates the home-building of cargo bikes in Christchurch. Again focusing on local doings, this chapter redirects the practice gaze to home-building as a means of achieving load-carrying. In so doing attention is given to the distribution of competence between the home-builder practitioner and the tools of home-building, the bundling together of home-building and load-carrying practices and the communities of practice which come together in this hobby activity. Changing household rhythms are found to catalyse home-building projects, with cargo bikes facilitating the continuation of cycling in circumstances where household commitments and needs might otherwise prompt a move to driving practices. The current version of this chapter is in preparation for submission to the Journal of Consumer Culture.

Chapter 7 zooms in on cargo-cycling in Portland, Oregon, making use of Birtchnell's conceptualisation of scale within practice theory to examine cargo-cycling activism in the development of a cargo cycle-based agility trial based upon a post-earthquake disaster scenario. The Disaster Relief Trials (DRT), first held in Portland in 2012, and now replicated in other cities is a celebratory event, designed to showcase the versatility and utility of cargo-cycling, as a tool to increase cargo-cycling, in tandem with increased disaster preparedness. Chapter 7 was first presented at the Sixth New Zealand Mobilities Symposium: Mobilities in a 'Dangerous World', 25-26 June 2015, University of Waikato, New Zealand. The current version of this chapter is in preparation for submission to the Journal of Transport Geography.

Chapter 8 starts to zoom out from accounts of situated cargo-cycling to investigate the social justice and equity implications of the relationship between cargo-cycling and car dependence, as manifested in the freight function of travel. Drawing on the transport disadvantage literature and scholarship on forced car ownership, cargo cycling is found to substitute for second car ownership. Chapter 8 has been revised following peer review and submitted to the journal Energy Research and Social Science.

Chapter 9 further zooms out from situated practices to think about hybridity, bifurcation of cycling practices, and the freight function of travel. Forming a speculative exploration of the transmodality of the cargo bike as a hybrid load-carrier, this chapter considers the enmeshment of load-carrying within a suite of daily practices, in a use-centred analysis of cargo-cycling in New Zealand and Portland. Chapter 9 is under preparation for submission to the journal Transfers.

# Chapter 5 Using Q methodology to understand load-carrying cycling practices in New Zealand

## 5.1 Introduction

Despite the growing literature on the experience of urban cycling (see for example Cox, 2015b; Jones, 2005; Jungnickel & Aldred, 2014), and increased policy attention to cycling as an everyday mode of urban transportation, little research has attended to the complexities of carrying loads whilst cycling. Policies and their evaluation have tended to focus on infrastructure, such as bike lanes and paths, and behaviour change programmes which seek to encourage pedal cycle use. Attempts have been made to draw lessons from Western cities which exhibit high cycling rates, to see whether similar strategies could increase cycling participation in towns and cities with lower rates of cycling. However, despite this interest in policy transfer, the role of equipment in promoting cycling as a mode of transport has garnered little attention. Indeed, despite the inclusion of a chapter on bicycle equipment (Lovejoy & Handy, 2012), in their edited volume *City Cycling*, Pucher and Buehler (2012b) make no mention of equipment in their concluding chapter, where they summarise 'key lessons for cycling promotion and successful implementation of cycling policies' (p. 350).

Several studies do, however, point to 'the difficulty of carrying loads while cycling' (Heinen et al., 2010: 59), and the practical constraints of transporting children on conventional pedal cycles (Mullan, 2012). Godefrooij, Pardo and Sagaris (2009) place particular significance on the limitations placed upon women and children's pedal cycle transportation, when suitable equipment is not available to facilitate the carriage of 'groceries, children, books and other cargo' (p. 26). The three year European Union funded study – *Cycle Logistics – Moving Goods by Cycle* - which concluded in 2014, and the subsequent CycleLogistics Ahead (2014-2017) programme, look at commercial, municipal, and domestic load-carrying by pedal cycle, paying particular attention to potential reductions in the energy intensity of urban freight logistics, by substituting cargo bikes for motorised vehicle trips. To this author's knowledge, little if any research has been conducted in non-European Western countries, specifically focused on load-carrying by pedal cycle.

As already noted, Pucher and colleagues (see for example Pucher & Buehler, 2008b; Pucher & Buehler, 2012a) have for a number of years sought to learn lessons from successful exemplars of the promotion of cycling, in an attempt to focus on what initiatives could be replicated in less successful cycling countries. Attempts to identify the potential for policy transfer need to account for local contexts. The practice turn has been claimed to offer a conceptual framework around which policy interventions can be built, particularly when directed towards engendering systemic change towards sustainability (Shove et al., 2012). Despite lacking one unified all-encompassing theory of practice (Postill, 2010; Shove, 2003a), the different way of thinking that the practice turn requires of researchers, has gained traction across a number of academic disciplines, including human geography. Fundamentally, the practice turn promotes practices as the core units of analysis, thereby subordinating both infrastructure and individual practitioners to the practice itself (Watson, 2012). Thus, in researching practices, a researcher is looking at what is being done, as according to practice theories 'doing something is always the performance of a practice' (Watson, 2012, p.: 488), the individual practitioner being located at the intersection of practices (Watson & Shove, 2008). One consequence of this focus is a challenge to behaviourist explanations of action which ascribe behaviour to individual attitudes and choices (Shove, 2010a). The analytical simplification of social practice theory (SPT) conceptualises a practice as being built of three elements - materials, competence, and meanings (Shove et al., 2012). While any practice is only seen to persist through moments of performance, when all three elements are brought together, SPTs main focus is the reproduction of the practice-as-entity through localised performance. According to SPT, rather than practices travelling through space and time, elements of practices travel and are brought together in recognisable but locally specific performances. This is a significant point, as it challenges ideas of direct policy transfer, which are not spatially and temporally localised.

Practice theories also lack a prescriptive set of research designs and methodological tools (Harvey et al., 2012), and while Nicolini (2012) has developed a theory-methods package for practice theoretical research in organisations, he still recommends a pragmatic eclecticism. Warde (2005) attributes this openness to eclecticism to the broad range of research questions which evolve from practice theoretical research, generating a need for 'breadth in method and techniques of interpretation' (p. 149). If, as Harvey et al. argue, suitable methodologies 'need to research meanings as they

are shared by practice-collectivities' (p. 3), methods which are capable of revealing those shared meanings need to the incorporated. Here, QM is employed as a technique for revealing those shared meanings. The *qualiquantological* heritage (Stenner et al., 2009) of QM presents a possible alternative approach to operationalising the practice turn, an approach which Stenner et al. claim, to some extent, crosses the 'divide' between quantitative and qualitative methods. Probing the potential for such an alliance, like Hitching's (2012) investigation of the use of interviews in researching routine practices, could at first glance be seen as an unlikely undertaking. Like Walker (2013), in his speculative conjoining of practice theory with Sen's capabilities approach, I initially justify this combining of QM with social practice theory (SPT) 'from the simple observation that both are concerned, at their heart, with what people do' (p. 182).

If doing something is always the performance of a practice, the collective doings as performances of a practice can be thought of as the practice entity. In QM the collective viewpoints of participants are represented in factors, the factors seeking to maximise the representation of the variance found within the study, in this case, the variance in how practitioners *do* load-carrying by pedal cycle. Here, in seeking to operationalise SPT using QM the factors are understood to represent the distribution of cycling load-carrying practice as performed by the practitioners who took part in the study, as statistically significant variants or sub-practices performed by the practitioners who loaded on a particular factor. I proceed as follows. First, the study is spatially and temporally located. QM is then briefly introduced, followed by an explanation of the operationalisation of QM in this study. The QM case study of load-carrying cycling practices is then presented, incorporating the interpretation of the factors analysed to be significant. The final section synthesises the findings from the factor analysis and offers some thoughts on the usefulness of this association between SPT and QM and their dual focus on what people do.

## 5.2 **Study background**

Cycling rates in New Zealand are low by comparison with many northern European countries, but comparable to those seen in the US, UK, and Australia. The *New Zealand Household Travel Survey 2011-2014* (Ministry of Transport, 2015a) finds 1 percent of trip legs to be made by pedal cycle, with cycling accounting for 1.6 percent of total travel time. Christchurch has traditionally seen a large by New Zealand standards, proportion of people cycling to work, particularly in the flat central city.

Statistics New Zealand (2015) report 6.8 percent (n=9804) of people in Christchurch using a pedal cycle as a commuting mode on Census day 2013. This figure was second only to the significantly smaller city of Nelson, with 8.4 percent (n=1524). The other city included in this study, Palmerston North, was at Census 1996 New Zealand's 'cycle to work capital' (Palmerston North City Council, n.d.) with 10.2 percent of people cycling to work, decreasing dramatically to third place with 5.7 percent (n=1791) at Census 2013.

## 5.3 Q methodology

The research technique QM was originally developed by William Stephenson in the 1930s. It is associated with a set of theoretical and methodological concepts designed to reveal the viewpoints of a group of participants, in a holistic and qualitatively detailed manner (Watts & Stenner, 2012). QM has been applied across many disciplines including human geography (Eden, Donaldson, & Walker, 2005; Robbins, 2009; Robbins & Krueger, 2000), public policy (Ockwell, 2008; Ray, 2011), urban mobility (Cools, Moons, Brecht, & Wets, 2009; Jones et al., 2012; van Exel, de Graaf, & Rietveld, 2011), sustainability (Barry & Proops, 2000; Curry, Barry, & McClenaghan, 2012), and social inclusion (Raje, 2007). There is ongoing debate among QM practitioners, about whether and how QM should be part of the dialogue concerning contemporary social theory and research practice, with some problematising applications which do not engage directly with 'Stephenson's own views' on the nature of subjectivity (Wolf, 2008: 9). As Stenner (2008) explains, these concerns broadly reflect opinion about whether QM should be treated as a technical method, used by social and psychological scientists within another theoretical framework, or as a philosophically underpinned methodology. Here QM is treated, in the spirit of pragmatic eclecticism, as a technical method, which has the potential to be useful in researching shared meanings (Harvey et al., 2012).

Irrespective of the epistemological and ontological underpinnings of any Q study, they will always include two specific elements, data collection via Q sort, and inter-correlation and by-person factor analysis, as opposed to the by-variable factor analysis seen in correlations such as *Pearson's r* (Watts & Stenner, 2012). A Q sort involves a participant sorting a collection of items/statements/images prepared by the researcher(s) in accordance with a subjective dimension, such as agreement/disagreement. Participants are selected on the basis of their ability to express a perspective 'that *matters*' (Watts & Stenner, 2012: 71, emphasis in

original), based upon their "expert" knowledge of the subject being considered. This means participants are able to express an opinion based upon pre-exiting knowledge, rather than a hypothetical position. Through the sorting process, the participant provides a model of their viewpoint on the particular issue being studied. The sorting patterns of each of the participants are subsequently compared and contrasted via factor analysis, allowing shared forms of understanding to be detected.

## 5.4 **The Q set**

The Q set is the collection of items sorted by the participants in the Q sort. Elicitation, based upon pictures or photographs, is widely accepted as a qualitative technique (Prosser & Loxley, 2008), there being evidence to suggest that respondents respond to and interpret photographs as indicators of the 'real' (Fairweather & Swaffield, 2001; Hawthorne, Krygier, & Kwan, 2008). Indeed, Watts and Stenner (2012: 57) suggest that, in ascertaining views about a range of artifacts, 'pictures would probably work much better than even the most articulate linguistic description'. In this study, images were used to generate the Q set, the images seeking to broadly replicate the range of styles of cargo-capable pedal cycles commonly used in Western countries, that might be readily found in cycling magazines and via internet searches. While the images are heterogeneous, their commonality lies in that they all refer to the particular subject matter under study (Watts & Stenner, 2012). In order for the final Q set to be of a manageable size, the items within it had to be sampled from the overall concourse of items contained within the source material, defined in terms of the research question. A multi-stage process was used reduce the Q set to 34 items. This was achieved by removing duplicates and then making use of a concourse matrix (Barry & Proops, 1999; Dryzek & Berejikian, 1993) to provide a representative sample of the remaining items, and then using random number tables (Dryzek & Berejikian, 1993) to further reduce the items to 34 in total (Figure 5-1).


1 long cargo bike

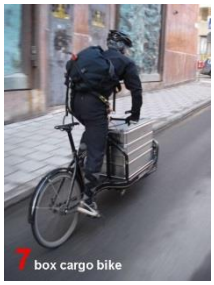

2 cargo bike


3 box cargo bike


4 trike


5 electric box cargo bike


6 box cargo bike


7 box cargo bike


8 load-carrying bike


9 trike


10 electric assist bike


11 electric assist covered trike


12 electric assist bike


13 tandem with child-carrying trailer & child seats


14 folding bike


15 family tandem


16 folding recumbent bike


17 covered recumbent trike


18 tag-along


19 long cargo bike


20 recumbent bike & trailer


21 large trailer & bike


22 child trailer & bike


23 cargo trike


24 cargo trike


25 electric assist covered recumbent trike


26 long cargo bike


27 recumbent trike


28 covered trailer & bike


**Figure 5-1 The 34 item Q set**

## 5.5 The Participants

In QM each participant becomes a variable, which means that participants should be selected on the basis of being 'theoretically relevant' (Brown, 1980: 192), knowledgeable, and having a viewpoint about the research question. Strategic sampling was therefore used to recruit the participants (or P set). The P set was drawn from people who already make use of pedal cycles for some of their load-carrying activities, and as a consequence were able to draw upon their existing practical and sensate knowledge of load-carrying by pedal cycle, in responding to the Q set. The intention was to draw on pre-existing cyclists, who had more recently decided they could carry loads by pedal cycle, as well as those with a longer history of such activity. People who carried children and/or inanimate loads were included representing a range of age and gender. Further, use of a range of different styles of pedal cycle was deliberately sought from conventional two-wheeled pedal cycles, with or without trailers, to cargo cycles and recumbents. In QM, as opposed to by-variable factor analysis, the number of participants only need to be enough to 'establish the existence of a factor for the purposes of comparing one factor with another' the proportion associating with any particular factor is a matter 'about which Q technique as such is not concerned' (1980: 192). In total 20 participants successfully completed Q sorts followed by in-depth interviews.

## 5.6 The Q sort procedure

Participants were asked to provide an assessment, by sorting the 34 numbered images comprising the Q set, from their own point of view of the type of pedal cycle that would, if they had little or no access to a car be *their ideal load-carrying bicycle to meet their transportation needs.* The participants were first advised to sort the

photos into three provisional ranking category piles, representing their most and least ideal load-carrying pedal cycles, and those sitting in between or that they were unsure about. Participants then proceed to a more fine-grained analysis by positioning the images in accordance with the Q matrix (Table 3).

**Table 3 The Q sorting matrix**

| | **Forced choice frequency distribution** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Least ideal** | | | | | | | | **Most ideal** |
| **Ranking value** | -4 | -3 | -2 | -1 | 0 | +1 | +2 | +3 | +4 |
| **Number of items** | 2 | 3 | 4 | 5 | 6 | 5 | 4 | 3 | 2 |

Once each participant had gone through the sorting procedure, the sort was recorded and a follow-up interview conducted, to gain further insight into the positioning allocated to the images on the Q matrix, and the participants' views on load-carrying practices.

## 5.7 **Statistical analysis**

A total of 20 Q sorts were inter-correlated and subjected to by-person factor analysis, using the dedicated statistical software PQMethod (Schmolck & Atkinson, 2002). A range of factor extraction solutions and rotations were examined in order to account for the maximum amount of variance, this being achieved with centroid (factor) analysis followed by varimax rotation and minor judgemental rotation (Watts & Stenner, 2005, 2012), all carried out within PQMethod. Factor loadings of ±0.44 were significant at the $p < 0.01$ level, and the factors were extracted on the basis of having eigenvalues (level of commonality of a factor) greater than 1.00. Four factors emerged, together explaining 62 percent of the study variance. Seventeen of the 20 Q sorts loaded significantly on one or other of the four factors, two sorts were confounded, loading significantly on more than one factor, and one sort did not load significantly on any of the four factors (Table 4).

Defining Q sorts for any of the factors extracted in this study, have exhibited similar sorting patterns, and share similar viewpoints regarding the suitability of types of bicycles for load-carrying practices – each factor's defining sorts show a distinct understanding of the usefulness of the technology. Those defining sorts for each

factor are merged within PQMethod to form factor arrays (Table 5) which are effectively ideal-type Q sorts based on weighted averaging. The weighted averaging process favours the higher loading sorts, as they better exemplify each factor. The process produces a factor array for each identified factor, each ultimately looking like a completed Q sort (Stenner, Cooper, & Skevington, 2003; Watts & Stenner, 2012).

**Table 4 Factor matrix with x indicating a defining sort**

| Q Sort | | Factor 1 | Factor 2 | Factor 3 | Factor 4 | $h^2$ (commonality) |
|---|---|---|---|---|---|---|
| 1 | 0001 | ***0.55x*** | 0.21 | 0.02 | -0.31 | 0.44 |
| 2 | 7147 | ***0.56x*** | -0.24 | -0.06 | 0.05 | 0.37 |
| 3 | 4558 | -0.11 | 0.42 | ***0.73x*** | -0.06 | 0.72 |
| 4 | 4444 | 0.39 | 0.38 | -0.26 | ***0.59x*** | 0.71 |
| 5 | 2309 | *0.51* | *0.53* | -0.28 | 0.01 | 0.62 |
| 6 | 1304 | 0.34 | 0.25 | 0.24 | ***0.49x*** | 0.48 |
| 7 | 5631 | -0.20 | ***0.77x*** | 0.09 | -0.01 | 0.64 |
| 8 | 7777 | ***0.69x*** | 0.00 | -0.12 | -0.04 | 0.49 |
| 9 | 8750 | ***0.85x*** | 0.09 | 0.06 | 0.07 | 0.74 |
| 10 | 6948 | ***0.80x*** | 0.04 | -0.29 | 0.33 | 0.83 |
| 11 | 9352 | 0.39 | -0.09 | 0.02 | -0.37 | 0.30 |
| 12 | 5011 | -0.03 | 0.36 | ***-0.65x*** | 0.01 | 0.55 |
| 13 | 2145 | 0.18 | -0.21 | 0.01 | ***0.65x*** | 0.50 |
| 14 | 5570 | -0.11 | -0.12 | ***0.57x*** | -0.08 | 0.36 |
| 15 | 1981 | ***0.71x*** | -0.01 | -0.11 | 0.27 | 0.59 |
| 16 | 0582 | 0.37 | ***-0.64x*** | -0.37 | 0.32 | 0.79 |
| 17 | 2412 | *0.62* | 0.33 | -0.19 | *0.58* | 0.87 |
| 18 | 2214 | -0.06 | 0.38 | ***0.81x*** | -0.06 | 0.81 |
| 19 | 1415 | 0.42 | ***0.60x*** | 0.10 | 0.32 | 0.65 |
| 20 | 1070 | 0.28 | ***0.85x*** | 0.13 | -0.11 | 0.83 |
| **Eigenvalues (commonality)** | | 4.6 | 3.4 | 2.4 | 2.0 | |
| **% of variance explained** | | 23 | 17 | 12 | 10 | |

Note: Significant loadings ($p<0.01$) are shown in italics. Defining sorts (significant on only one factor) are indicated by ***x***, $h^2$ is the sum of the squares of factor loadings by rows, and eigenvalues are the sum of squares by column.

**Table 5 Factor Array**

| Images | | Factor | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| 1 | Longtail cargo bike | +2 | +2 | +2 | +2 |
| 2 | Cargo bike with front above wheel lockable box | 0 | 0 | 0 | -1 |
| 3 | Box cargo bike | +1 | +2 | +1 | -1 |
| 4 | Upright trike | -1 | -1 | -3 | +2 |
| 5 | E-assist box cargo bike | +1 | +3 | -1 | 0 |
| 6 | Box cargo bike | 0 | +4 | +1 | -1 |
| 7 | Box cargo bike with metal covered lockable box | +2 | -1 | 0 | 0 |
| 8 | Bike with front carrier above wheel & rear racks | +2 | +1 | 0 | -4 |
| 9 | Long wheelbase semi-recumbent trike | +1 | -1 | -3 | +1 |
| 10 | E-assist step-through bike with racks | +2 | +1 | -2 | 0 |
| 11 | E-assist covered pedicab | -1 | 0 | -4 | +4 |
| 12 | E-assist step-through bike with panniers | +4 | 0 | -2 | +3 |
| 13 | Tandem with child seats, panniers & covered child trailer | -4 | +2 | +3 | -2 |
| 14 | Folding bike with basket | 0 | -2 | -1 | -3 |
| 15 | Family tandem | -4 | 0 | +2 | -3 |
| 16 | Folding recumbent bike with panniers | -1 | -4 | 0 | -2 |
| 17 | Recumbent trike semi-covered | -1 | -3 | -2 | 0 |
| 18 | Tag-along | -3 | 0 | +3 | -4 |
| 19 | Longtail cargo bike with child | +3 | +3 | +3 | +4 |
| 20 | Recumbent bike with panniers/baskets & trailer | 0 | -2 | +2 | -1 |
| 21 | Bike & large open trailer | +4 | -1 | +2 | +3 |
| 22 | Covered child trailer & bike with panniers | -2 | +1 | +4 | +1 |
| 23 | Cargo box trike with awning covered child carrying | -1 | +4 | +1 | +1 |
| 24 | Christiania box cargo trike | +1 | +3 | -2 | +1 |
| 25 | Solar E-assist covered recumbent trike | +1 | -2 | -4 | +2 |
| 26 | Longtail cargo bike with boxed load | +3 | 0 | +1 | +2 |
| 27 | Recumbent trike with panniers and rear rack | -2 | -3 | -2 | -2 |
| 28 | Small covered trailer & bike | +3 | -2 | +1 | +3 |
| 29 | Recumbent trike with child carrier | -3 | -1 | -1 | 0 |
| 30 | Traditional step-through bike with basket | 0 | +1 | 0 | -3 |
| 31 | Covered cargo trike | -2 | +2 | 0 | -1 |
| 32 | Velomobile | -2 | -4 | -3 | 0 |
| 33 | Bike with child trailer & child seat | -3 | +1 | +4 | +1 |
| 34 | Folding bike – folded | 0 | -3 | -1 | -2 |

## 5.8 **Interpreting the factors**

Factor interpretation is based upon the analysis of the patterning of the items in the factor array, with the assistance of comments from the post-sort interviews. Ultimately, the interpretation process aims to 'uncover, understand and fully explain' (Watts & Stenner, 2012: 181) the perspective encapsulated by each factor and shared by the participants loading on that factor. Here, each factor is characterised as a distinct practice-variant of load-carrying, based upon its Q sort and the participants loading significantly on it (Fairweather & Swaffield, 2001). For each practice-variant/factor, the most significant aspects of that factor are captured in four basic categories, those given the highest and lowest rankings in each factor, and those ranked higher or lower than by any other study factor (Watts & Stenner, 2012). Consequently, the images corresponding to the most (+4 and +3) and least (-4 and -3) ideal pedal cycles for that factor, and the pedal cycles ranked higher or lower by that factor than any other, are incorporated into accompanying factor diagrams (Figures 5-2, 5-3, 5-4 and 5-5). In this way, the diagrams show both the most important aspects of the polarisation of each of the practice-variants, and also how the practice-variant is polarised '*relative* to the other study factors' (Watts & Stenner, 2012: 153, emphasis in original). In presenting each practice-variant as a a single visual representation, Figures 5-2 to 5-5 include the most and least important images for that factor within the red (+/-4) and green (+/-3) shapes, and within the grey shape, the most and least important images relative to the other factors. Hence, images that appear twice are those which are not only significant for the factor under consideration but also more/less important to that factor, relative to the other factors. This means that images ranked +/-4 and +/-3, but not included within the grey outer shape, may, whilst being important to the factor under consideration, also be important to other factors, as in the consensus images identified below.

The diagrams are each accompanied by an interpretation of each factors Q sort, illustrated with quotations from participants loading significantly on that factor. All four factors show statistical consensus regarding three images (Table 6). The cargo bike (2) generates an ambivalent response from all factors, and two longtail cargo bikes (1 and 19) generate the greatest level of unanimity in terms of their utility as a means of achieving load-carrying practices with a pedal cycle.

**Table 6 Consensus Statements**

| Images | | Factors | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| 1* |  | +2 | +2 | +2 | +2 |
| 2 |  | 0 | 0 | 0 | -1 |
| 19* |  | +3 | +3 | +3 | +4 |

(non-significant at P>.01, * also non-significant at P>.05)

In the next section, each factor is described in association with a summary of its demographic profile (Table 7). For additional clarification, rankings of items are included and participant comments are cited. Ranking notation includes the item number and the ranking it achieved in the relevant factor, for example in factor 4, item 2 was ranked -1 and is therefore notated as (2: -1).

**Table 7 Demographic profile for each factor**

| | Factor | | | | | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | | 2 | | | | 3 | | | | 4 | | No significant loading | | |
| | | | 2a | | 2b | | 3a | | 3b | | | | | | |
| | F | M | F | M | F | M | F | M | F | M | F | M | F | M | |
| Gender | 5 | 1 | 3 | 0 | 1 | 0 | 1 | 2 | 1 | 0 | 2 | 1 | 1 | 2 | 20 |
| Age band | 50s | 30s | 20s-40s | | 60s | | 30s | 20s-30s | 30s | | 50s-70s | 30s | 60s | 20s-30s | |
| Cargo bike experience | 2 | | 3 | | | | | 1 | | | | 1 | | | 7 |
| Born overseas | 2 | | 1 | | 1 | | | 1 | 1 | | | 1 | | | 7 |
| Significant time living overseas | 2 | | 3 | | 1 | | | 1 | 1 | | | 1 | | | 9 |

In a departure from standard practice, based mostly upon the sorting of statements rather than the images used for this exploratory study, and consistent with SPT's emphasis on analytical simplicity (Shove et al., 2012; Shove & Spurling, 2013), the factor descriptions are summarised in point rather than discursive form.

### 5.8.1 Factor 1: Functional two-wheeled load-carrying practices

Factor one (Figure 5-2), has an eigenvalue of 4.60 and explains 23 percent of the study variance. Six participants are significantly associated with this factor, five are females in their 50s, and one is a male in his 30s. Two of the participants have lived outside of New Zealand for a significant period of time, and two have direct experience of using longtail and front-loading cargo bikes.

Functional two-wheeled load-carrying practices demand cycles that handle like conventional two-wheeled pedal cycles (12: +4; 21: +4; 19: +3; 26: +3; 28: +3), exhibiting the following characteristics:

1. Longtail cargo cycles are popular (19: +3; 23: +3) as they are cargo-capable without noticeably affecting pedal cycle handling.
2. Conventional two-wheelers are also versatile, with racks allowing panniers to be attached to carry equipment and shopping. When it is necessary to carry additional loads, a trailer can be added. Just attaching a trailer when actually needed means that day-to-day riding is unencumbered.
3. Trailers are useful for carrying inanimate loads – the major practices of this group of practitioners.
4. Child-carrying practices are not part of these practitioners lives (13: -4; 15: -4; 18: -3; 29: -3; 29: -3; 33: -3; 22: -2 ; 23: -1 ;31: -2). However, cycles which, whilst being practical for child-carrying, can easily accommodate static loads can still be useful (19: +3; 26: +3).
5. Whilst it is important for a pedal cycle to look "normal" and exhibit conventional riding characteristics, even a front-loader designed specifically for load rather than child-carrying might be acceptable (7: +2).
6. Prioritising the practicalities and feel of riding a conventional two-wheeled bike, means that most three-wheelers are not viable (29: -3; 23: -1; 31: -2), particularly when designed primarily to carry children. This logic extends to child trailers, even if they could be capable of carrying static loads (33: -3; 22: -2).

7. One semi-upright three-wheeler (9: +1) with two wheels at the rear, and unambiguously designed for loads, is more favoured by practitioners significantly associated with Factor 1 than by most other practitioner groups.

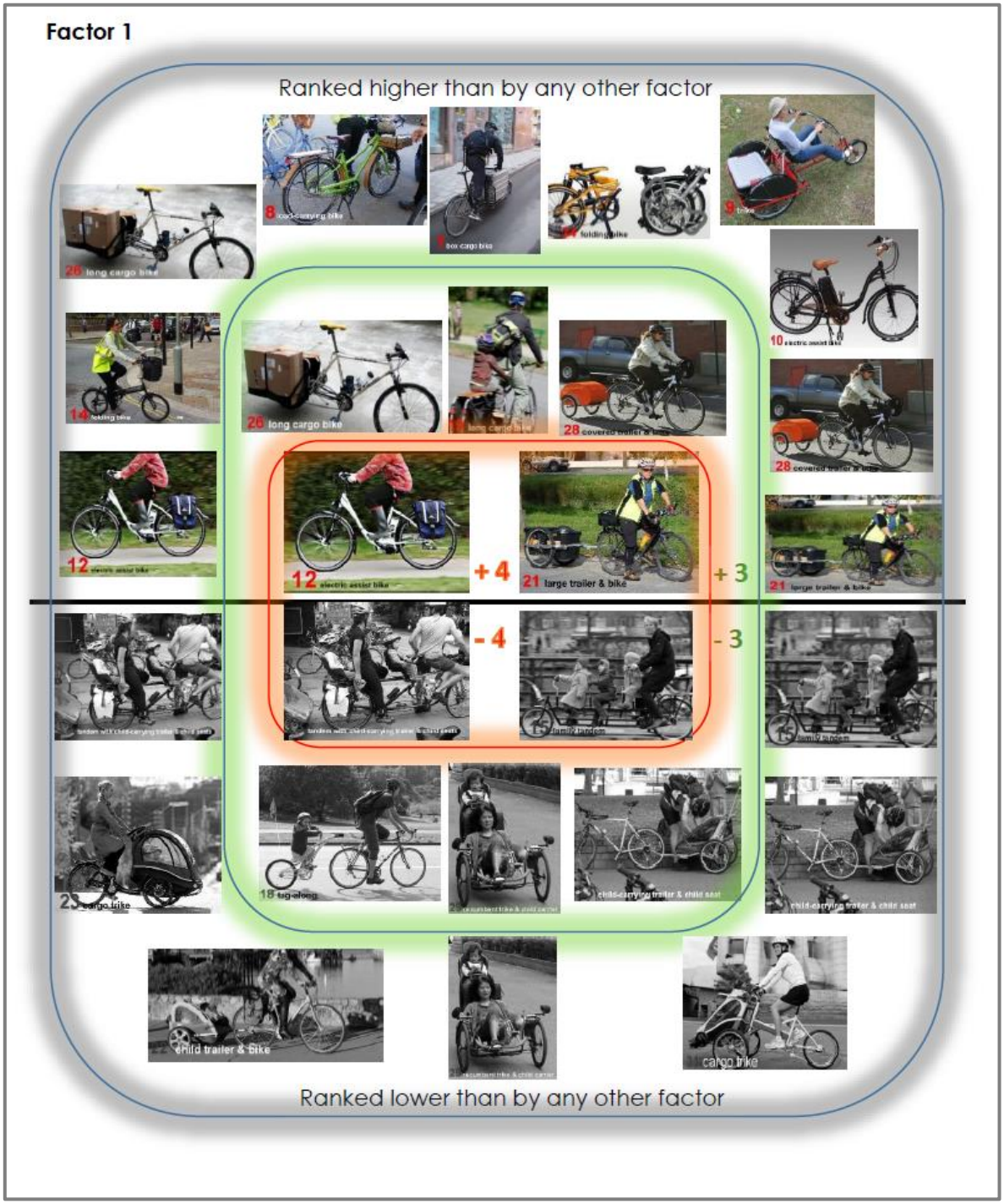



**Figure 5-2 Factor 1**

8. For some activities, E-assist is helpful (12: +4; 10: +2), either now or possibly in the future, so pedal cycles which can be retrofitted are a good idea.

9. Folding bicycles can assist in combining commuting and shopping practices (14: 0; 34: 0), particularly where part of a journey could be made by public transport. Folding bikes can also easily be carried in the back of a car.

Box 1- Comments from functional two-wheeled load-carrying practitioners:
*'What I use now is a bike with panniers, I can get most of my groceries into those, occasionally a trailer would be marvellous, but an electric assist would also be really good because living up a hill there are occasions when I have a load of groceries when I think, one day I'm going to get one, I haven't quite made that jump yet' (8750).*

*'Electric bikes – it brings a lot of fun back … to go 600km it's cost me $1.40 … I love them, I know how much I use mine … I love the fact I can get on my bike and ride as far as I want' (6948).*

### 5.8.2 Factor 2

Factor 2 (Figure 5-3) has an eigenvalue of 3.40, explains 17 percent of the study variance, and is a bi-polar factor. This means that two opposed viewpoints are expressed by participants who load on this factor. Four participants are significantly associated with this factor, they are all female, and range in age from late 20s to 60s. One participants was born and has lived for a significant period outside of New Zealand, and the other three have all spent significant periods of time outside of New Zealand.

#### 5.8.2.1 Factor 2a: Child-focused cargo cycle practices

All three participants significantly associated with Factor 2a have experience of using cargo bikes, one with a longtail, and two with front-loaders with different configurations. Factor 2a is directly represented in Figure 5-3, where:

1. Child-focused load-carrying practices are best accomplished using a cargo cycle (6: +4; 23: +4: 5: +3; 19: +3; 24: +3; 3: +2). They combine practices of child-carrying, shopping and working by pedal cycle. While participants significantly associated with Factor 2a have access to a car, they prefer to travel by pedal cycle wherever possible, and so need a cycle that can carry combinations of goods and children. Cargo cycles are a versatile way of carrying children, and the baggage associated with them.
2. Experience of front-loaders and longtails increases the likelihood of adopting this practice-variant.

3. If stability whilst loading, and when for instance stopping at traffic lights, is a priority, the three wheeled front-loader is a good option.


**Figure 5-3 Factor 2 (note: this figure represents Factor2a, Factor 2b is a mirror image of 2a)**

4. Depending on household location and travel distance, E-assist may be either essential or an option for the future (5:+3).
5. Cargo-trikes are not favoured for hilly areas, even with E-assist.
6. Because carrying children in combination with other loads is the priority, pedal cycles least able to facilitate this bundling of practices are least

favoured (32: -4; 34: -3). Recumbents are seen to most clearly represent this category (16: -4; 17: -3; 27: -3; 20: -2). Recumbents combine images of 'weirdness' with lack of visibility/safety.

7. Bicycles towing a trailer are clearly an option for child-carrying, but child safety concerns mean cargo cycles are preferred over bicycle/trailer combinations.

Box 2a - Comments from child-focussed cargo cycle practitioners:
*'The concept of carrying loads on bicycles was kind of familiar … I've always cycled, I've always loved it, and then when I got my second child I could no longer transport my children on the same bicycle. I went looking for options … Googling and came across the Dutch websites .. they're fantastic but they're €1800 before you get them to the other side of the world. I ended up getting this one from Australia, I did it myself really, and found a local bike shop that as willing to assemble it for me … it's a Chinese made version of a Dutch bike' (5631).*

*'Quite frequently on the way home from school I'll … go to the veggie shop, I'll go to the health food shop' (5631).*

#### 5.8.2.2 Factor 2b: Recumbent car-free retirement practices

Factor 2b, being the mirror image of Factor 2a requires reverse interpretation in Figure 5-3. Recumbent car-free retirement practices clearly favour recumbent trikes and bicycles (16: -4; 32: -4; 17: -3; 27: -3; 9: -1):

1. Recumbents are the best option for mobility in retirement, as it is possible to contemplate multiple journey types whilst accommodating the physical limitations encountered with increasing age, to maintain car-free status.
2. Any bikes that can meet these needs, including partially or fully enclosed recumbents (17: -3; 32: -4) will be considered.
3. Maintaining car-free cycling is assisted by using a trailer to increase cargo-capability (20: -2), which not only increases versatility but also lowers the centre of gravity for stability.
4. E-assist is worth considering on a recumbent (25: -2).
5. Another way of achieving versatility and carrying more goods is to use an upright bicycle with either a large (21: -1) or covered trailer (28: -2), frame

extending Xtracycle™ (26: 0), or even a front-loader so long as it has a box designed specifically for carrying goods (7: 1).

6. A folding bicycle can be useful in certain circumstances, such as when travelling by other modes such as the train (16: -4; 34: -3).
7. Bikes and bike/trailer combinations which appear to be designed primarily for child-carrying are of no practical use (23: +4; 6: +4; 31: +2; 18: 0; 23: +1; 33: +1; 13: +2). A significant reason for rejecting these options is the pedal cycle configuration not providing the riding characteristics of a conventional bicycle, or the advantages of a recumbent.

Box 2b - Comments from recumbent car-free retirement practitioners:
*'The plan is to use part of my retirement gratuity to buy a tandem recumbent trike and we'll probably be towing a cart behind it' (0582).*

*'For grocery shopping, we have a Burley [2 wheel trailer]– a pretty decent sized Burley actually so all the grocery shopping is done with it, in between that and panniers on the back – we can get a weeks' shopping into the Burley no problem … it's been at least 19 years that we've not owned a car' (0582).*

### 5.8.3 Factor 3

Factor 3 (Figure 5-4) has an eigenvalue of 2.4 and explains 12 percent of the study variance. It is also a bi-polar factor, meaning that again two opposed viewpoints are expressed by participants who load on this factor. Four participants are significantly associated with this factor, two are female and aged in their late 20s - 30s, and two are male and also in their late 20s - 30s. Two participant were born and have lived for significant periods outside of New Zealand. Only one participant has experience of riding a longtail cargo bike.

#### 5.8.3.1 Factor 3a: Conventional child-carrying cycling practices

Factor 3a is directly represented in Figure 5-4, the prime need being to transport children:

1. A pedal cycle specifically designed to accomplish this task (22: +4; 33: +4; 13: +3; 15: +3; 18: +3; 19: +3), with or without a trailer, is the best option.
2. A bike or trike which can securely transport children, but can also be used as a load/shopping carrier can also be valuable (6: +1; 3: +1), especially if it offers weather-proof accommodation for the children (23: +1).

3. Previous exposure to different forms of child-carrying bike influences purchase choices.
4. The most desirable means of transporting children is an enclosed child trailer towed behind a conventional diamond frame bike (22: +4; 33: +4). A good quality conventional diamond frame bicycle, with the addition of a trailer, can accommodate loads and offers flexibility, and is nice to ride when the trailer is not being used.


**Figure 5-4 Factor 3**

5. Longtails are preferable to front-loaders as they ride more like a regular bike.
6. Trikes which offer no integrated child-carrying options (4: -3; 9: -3; 27: -3; 17: -2) are less favoured by Factor 3a than any other factor.
7. Bikes designed primarily for shopping/freight type loads (2: 0), even with E-assist (12: -2; 10: -2), are less useful to Factor 3a than any other factor.
8. Folding bikes (34: -1; 14:-1) are not useful to Factor 3a, as managing a folding bike, trailer and children on public transit is too hard.
9. Least useful to Factor 3a are the covered E-assist trikes (11: -4; 25: -4) and the velomobile (32: -3) as they offer no obvious means of carrying a child, and are designed for speed.

Box 3a - Comments from conventional child-carrying pedal cycle practitioners:
*'Being well designed for riding is the most important feature. It needs to be fun too, not just hard work! Heavy designs and single speeds are not fun to ride' (5570).*

**5.8.3.2 Factor 3b: Stable riding practices**

Factor 3b, being the mirror image of Factor 3a, requires reverse interpretation in Figure 5-4. Factor 3b preferring to ride trikes rather than bicycles for the additional stability they offer alongside cargo-capability:

1. Lack of cycling confidence is overcome by not having to worry about balance whilst riding, allowing the rider to gain the health benefits of cycling whilst saving energy and reducing pollution by cycling rather than driving.
2. More upright trikes are preferred over fully recumbent trikes with delta and tadpole wheel configurations being equally viable for stable load-carrying.
3. With no need to transport children, pedal cycles designed for this purpose are not relevant.
4. Attaching trailers to two-wheeled bicycles compounds problems with stability and confidence.

Box 3b - comments from stable riding practitioners:
*'I find them [trikes] to be reliable and safe, the only downfall is they don't fit in a car easily to take to other places' (5011).*
*'I am quite fascinated by picture 11 … I would consider using it as one of my main modes of transport because of the cover (rain/ shine), and with the electric assistance, it will help going uphill or for longer distance travel' (5011).*

### 5.8.4 Factor 4: Electrically assisted practices

Factor 4 (Figure 5-5) has an eigenvalue of 2.0 and explains 10 percent of the study variance. Three participants are significantly associated with this factor, two female and one male. These participants range in age from their30s to 70s. One participant was born and has lived for a significant period of time outside of New Zealand. One participant regularly rides an E-assist cargo bike. Factor 4:

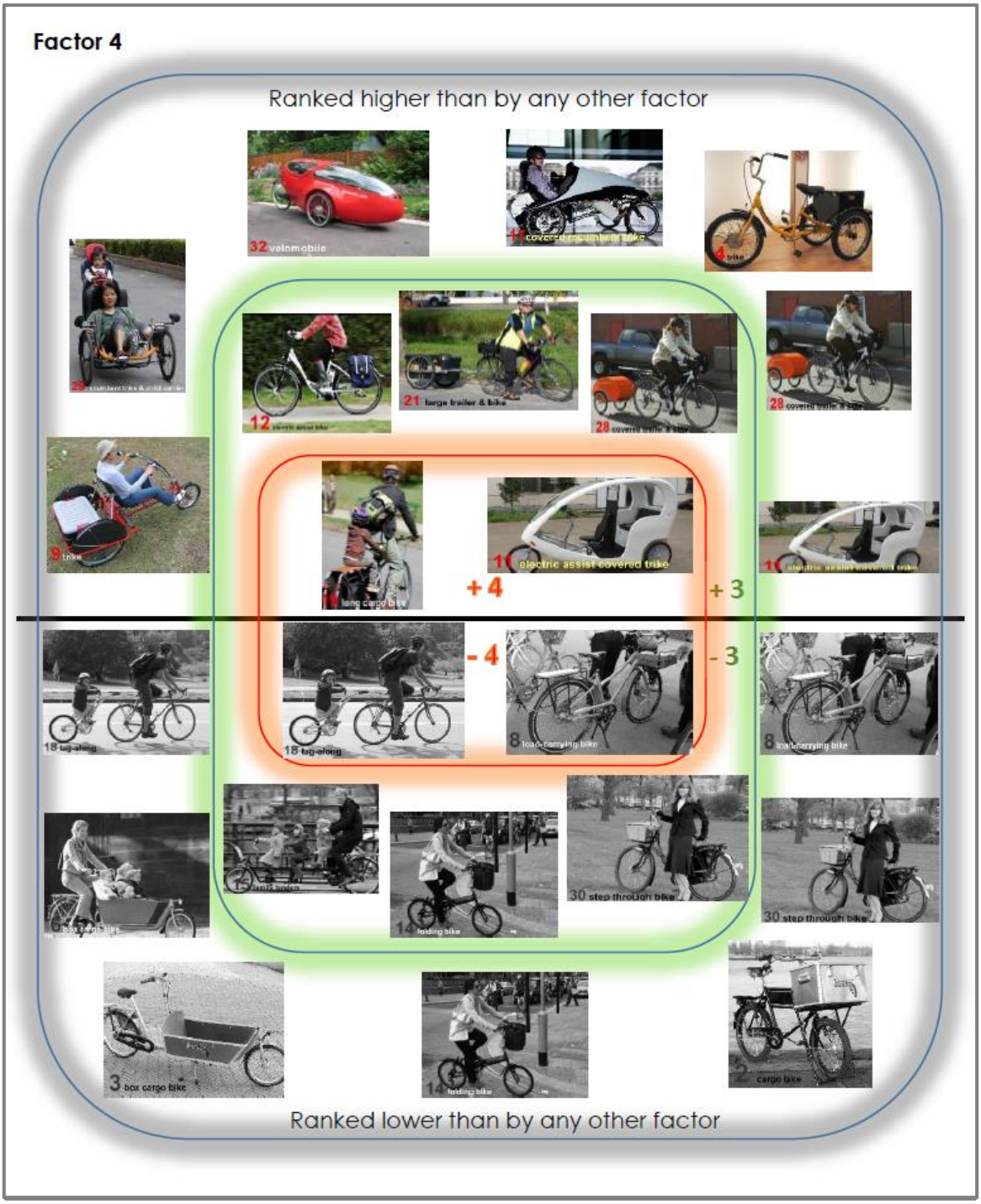



**Figure 5-5 Factor 4**

1. Does not have any need to carry children (15: -3; 13: -2; 18: -4; 6: -1), or a bike which can be folded and used in conjunction with other forms of transportation (14: -3; 16: -2; 34: -2).
2. No-nonsense, robust cargo-capability is important (19: +4; 1: +3; 26: +3), the load needing to be carried behind the rider (11: +4; 19: +4; 1: +3; 12: +3; 26: +3).
3. E-assist is nice to have (11: +4; 12: +3; 25: +2) and crucial for getting home, up-hill with a load on a long-tail cargo bike, or when faced with a strong head-wind. It can make the difference between cycling and driving on bad weather days.
4. Two-wheeled trailers (21: +2; 28: +2) add load cargo capability, coupled with the versatility of being able to remove the trailer when not required.
5. Although not trike users, Factor 4 is more willing to consider trikes (11: +4; 4: +2), including recumbent trikes (25: +2; 29: 0), than any other group. This willingness also extends, more than to any other group, to the use of covered and semi-covered trikes (11: +4; 17: 0; 32: 0).

Box 4 – Comments from electrically assisted practitioners:
*'Personally, I've had very good experience with electric long[tail] cargo bikes' (4444).*
*'Electric assist is nice to have' (1304).*
*'I like trailers more than panniers on a bike but I don't want to look nerdy … I don't want to look like a freak, I want to look like a no nonsense road user normalising cycling' (1304).*
*'An electric assisted one [velomobile] would be a very good way to get people out of their cars' (6948).*
*'If all else fails it will get me home without doing any work at all!' (2145).*

## 5.9 **Consequences and conclusions**

Identifying the practices, people who already have some experience of cargo-capable cycling in New Zealand participate in, provides an exploratory window into the types and ordering of activities combined with mobility practices. The QM analysis reveals a four-way bifurcation of load-carrying using cargo-capable pedal cycles, two of the four bifurcations revealing further division into diametrically opposed (bi-polar) practices. The post-sort interviews expand upon the sorting process, to show a nuanced (non-)attraction of practitioners to the identified sub-practices. This

attraction is founded upon integration of need, largely connected to the combination of load-carrying activities to be achieved, embodiment of pedal cycle-handling skills and safety characteristics, previous exposure to sub-practices, and to a lesser extent the potential to further hybridise the pedal cycle-human relationship with the addition of E-assist technology. While the analysis points to variable mechanisms for achieving a range of load-carrying activities, some cross-cutting themes can be identified.

The images used in the Q sorts can be reordered on the basis of their design characteristics (Table 8), broadly grouping for instance longtails, front-loaders, recumbents, trailers and E-assist bikes together in categories. This is a useful exercise in showing overall dominance, and relationships across the sub-practices. As already noted (Table 5 and 6), there is consensus across the factors concerning the viability of the two pedal cycles shown in images 19 and 1. Both of these are longtail cargo cycles which have frames extended to the rear of the pedal cycle to increase the cargo-capability, whilst maintaining many design features of conventional diamond- frame bicycles. As shown in the images these longtails can combine the carriage of children and other loads, whilst maintaining conventional pedal cycle handling characteristics. Whilst some of the participants had experience of riding longtails, the consensus suggests that participants without this experience could, on the basis of their own cycling experience conceptualise the use of longtails more easily than other more "unusual" looking pedal cycles. Further, these longtails also present a less 'freaky' image than some of the other cargo-capable pedal cycles, which are less familiar on New Zealand streets.

There are some important points of distinction between and within practices, as seen in the bi-polar factors. The idea of familiarity and recognisable characteristics, is pertinent in relation to the partially enclosed E-assist trike (image 11) which was observed during what Pink (2012: 40) calls engaged participant observation of the sorting practice as it was performed, to be an image which while often initially placed upon the least ideal pile in the first stages of the sorting process, was subsequently moved up the ranking so that for Factors 4 and 3b, this image acquires +4 ranking. While this sort of machine would be unfamiliar to many of the participants, with similar units only having being imported to New Zealand in subsequent years, this sort of technology (as explored in Chapter 9) incorporates some characteristics familiar to drivers of small cars.

**Table 8 Factors reordered by design characteristics**

| Images | | | Factor | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | | 3 | | 4 |
| | | | | a | b | a | b | |
| LONGTAIL | 1 | Longtail cargo bike | +2 | +2 | -2 | +2 | -2 | +2 |
| | 19 | Longtail cargo bike with child | +3 | +3 | -3 | +3 | -3 | +4 |
| | 26 | Longtail cargo bike with boxed load | +3 | 0 | 0 | +1 | -1 | +2 |
| FRONT-LOADER | 2 | Cargo bike with front above wheel lockable box | 0 | 0 | 0 | 0 | 0 | -1 |
| | 7 | Box cargo bike with metal covered lockable box | +2 | -1 | +1 | 0 | 0 | 0 |
| | 3 | Box cargo bike | +1 | +2 | -2 | +1 | -1 | -1 |
| | 6 | Box cargo bike | 0 | +4 | -4 | +1 | -1 | -1 |
| | 5 | E-assist box cargo bike | +1 | +3 | -3 | -1 | +1 | 0 |
| | 24 | Christiania box cargo trike | +1 | +3 | -3 | -2 | +2 | +1 |
| | 23 | Cargo box trike with awning covered child carrying | -1 | +4 | -4 | +1 | -1 | +1 |
| | 31 | Covered cargo trike | -2 | +2 | -2 | 0 | 0 | -1 |
| TRIKE OR RECUMBENT | 4 | Upright trike | -1 | -1 | +1 | -3 | +3 | +2 |
| | 9 | Long wheelbase semi-recumbent trike | +1 | -1 | +1 | -3 | +3 | +1 |
| | 27 | Recumbent trike with panniers and rear rack | -2 | -3 | +3 | -2 | +2 | -2 |
| | 17 | Recumbent trike semi-covered | -1 | -3 | +3 | -2 | +2 | 0 |
| | 16 | Folding recumbent bike with panniers | -1 | -4 | +4 | 0 | 0 | -2 |
| | 20 | Recumbent bike with panniers/baskets & trailer | 0 | -2 | +2 | +2 | -2 | -1 |
| | 29 | Recumbent trike with child carrier | -3 | -1 | +1 | -1 | +1 | 0 |
| | 32 | Velomobile | -2 | -4 | +4 | -3 | +3 | 0 |
| E-ASSIST | 11 | E-assist covered pedicab | -1 | 0 | 0 | -4 | +4 | +4 |
| | 25 | Solar E-assist covered recumbent trike | +1 | -2 | +2 | -4 | +4 | +2 |
| | 10 | E-assist step-through bike with racks | +2 | +1 | -1 | -2 | +2 | 0 |
| | 12 | E-assist step-through bike with panniers | +4 | 0 | 0 | -2 | +2 | +3 |
| CONVENTIONAL | 8 | Bike with front carrier above wheel & rear racks | +2 | +1 | -1 | 0 | 0 | -4 |
| | 30 | Traditional step-through bike with basket | 0 | +1 | -1 | 0 | 0 | -3 |
| TRAILER | 21 | Bike & large open trailer | +4 | -1 | +1 | +2 | -2 | +3 |
| | 28 | Small covered trailer & bike | +3 | -2 | +2 | +1 | -1 | +3 |
| | 33 | Bike with child trailer & child seat | -3 | +1 | -1 | +4 | -4 | +1 |
| | 22 | Covered child trailer & bike with panniers | -2 | +1 | -1 | +4 | -4 | +1 |
| | 18 | Tag-along | -3 | 0 | 0 | +3 | -3 | -4 |
| | 13 | Tandem with child seats, panniers & covered child trailer | -4 | +2 | -2 | +3 | -3 | -2 |
| OTHER | 15 | Family tandem | -4 | 0 | 0 | +2 | -2 | -3 |
| | 14 | Folding bike with basket | 0 | -2 | +2 | -1 | +1 | -3 |
| | 34 | Folding bike – folded | 0 | -3 | +3 | -1 | +1 | -2 |

This reaction to image 11 is in step with analysis which shows a striking level of willingness to consider E-assist, either in the present or for the future. This willingness was notable in men and women and across the age range of those interviewed. E-assist is variously considered useful in carrying heavy loads, including combined loads of children and goods, supporting cycling in hillier areas, coping with headwinds, supporting the uptake or continuation of cycling with advancing age, and increasing the range and number of cycle trips that can be achieved in a particular timeframe.

These results provide insights into how the load-carrying limitations of conventional pedal cycle design, coupled with the daily reality of needing to transport cargo or passengers identified (Dickinson et al., 2003; Lovejoy & Handy, 2012; Mullan, 2012) can be overcome. Load-carrying is a facet of a number of practices, and the combination of technologies, combined within a particular design of pedal cycle, make it variously capable of meeting need for multiple forms of load-carrying. For instance, for Factor 3a, the addition of a trailer to a conventional bicycle is for some practitioners a versatile mechanism for load-carrying of goods and/or children at a relatively low cost. Versatility is emphasised in terms of it being possible to unhitch the trailer when not required, but this is also regarded as a drawback given the need for pre-planning of load-carrying. Some practitioners (Factor 2a) regard trailers, particularly for children as vulnerable and hard to monitor. Users of purpose built cargo cycles emphasise their versatility, the potential for continuous engagement with the children being transported, and the opportunistic activities such as transporting additional children 'for play-dates' that the cargo cycle facilitates.

This study also has theoretical and methodological implications. Employing the *qualiquantology* of QM as a technique for investigating practices, resonates with Warde's (2005) call for breadth of method in practice theoretical investigation, such as seen in the quantitative techniques used by Browne, Medd, & Anderson (2012), to follow "traces" of practice collectivities, the other practices such as shopping and child transportation that interweave with riding cargo-capable pedal cycles. The application of photograph-based QM accompanied by post-sort interviews captures rich insights into complex bifurcating practices, by using photographs as an alternative route to knowledge (Pink, 2012). Identification of the four statistically

significant factors presents a powerful way of exploring practice variation, which here serves as a sensitising process (Bacchi, 2009) for further investigation (reported in subsequent chapters). The factor depictions (Figures 5-2 – 5-5) used to illustrate the practice-variant descriptions, aid understanding of the nuances of intra- and inter-practice variation, based upon objects as observable manifestations of practice (Pristed Nielsen & Møller, 2014). These depictions not only show the most significant cargo bikes for a sub-practice as depicted in the two inner shapes, showing the five most (in colour) and least (in black and white) ideal load-capable bikes, but also re-inforce the particularity of the significance in the outer grey shape, which clarifies which of the five bikes in the inner rings impact more significantly on the sub-practice in question than any other practice.

This study thus counters the trend observed by Lovejoy and Handy (2012), in academia and planning, of largely ignoring equipment's role in supporting urban cycling, despite the recent proliferation of cycle designs oriented to practices of cycle-based urban mobility (Pucher & Buehler, 2012b). These are not fixed and definitive generalizable categories of the only possible variation in load carrying cycling practices that exist in this, or other populations. Rather, they are examples of how if analysis is focused on practices, it is possible to present a detailed and nuanced picture of practices and their diversity. This study, therefore, has several potential policy implications.

As experienced load-carrying practitioners, the participants highlight the value of having access to a pedal cycle which meets their various load-carrying needs, and the flexibility that a suitably designed pedal cycle offers, in terms of achieving various practice activities, particularly when transportation of a child, or living with little or no access to a car is a reality and/or choice. While the majority of the participants in this study did have access to a car, their preference was to cycle where possible, and the range of practices they could achieve with a pedal cycle increased their ability to avoid the use of more carbon intensive modes. In SPT, practice performance is contingent on the bringing together of three elements - materials, competence, and meanings. In this QM study practitioners were asked to consider an image of a particular material element, the pedal cycle, without which the practice of cycling cannot occur. In considering which pedal cycles could most meet their load-carrying needs, it became clear from the follow-up interviews, that the contextualisation of pedal cycles as material objects, was based upon their relationship with other

material elements such as road conditions, but also the perceived competence of the participant with alternative pedal cycle handling characteristics, and the meanings suggested by pedal cycle configurations and styles, such as 'stable' or 'freaky'. As practitioners already recruited to the practice of load-carrying cycling, in practice terms this study suggests the temporal and spatial context of need is important in selecting a pedal cycle.

Load-carrying by pedal cycle thus incorporates a number of distinctive, but closely related cycling sub-practices. Each practice shares common elements but precise configurations show distinctive variation. Sub-practices are seen to recruit practitioners based upon the activities they need to perform, and the material affordances, competences and images embodied in those sub-practices. These variations have significance for people involved in planning for and facilitating decarbonised mobility, as potentially pedal cycles, such as the longtail, which can meet a spectrum of need, and overcome some of the problems of performing multiple practices such as child transportation, shopping and commuting (Godefrooij et al., 2009; Mullan, 2012), can reduce defection, particularly for women from cycling practices, due to life changing events such as the birth of a child.

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## 5.10 **Practice summary**

The visual representation of the practice dynamics zoomed in upon in Chapter 5 (Figure 5-7) represents a development of the original tripartite visual schema proposed in Chapter 4 (Figure 4-2). Here the cargo-cycling entity is observed to bifurcate into the recognisable, but distinct practice-variants of cargo-capable cycling. Different strands of the bifurcation are observed to intersect with the other dominant practices of child and goods transportation, which, in this indicative study, influence the statistically significant practice configurations identified.

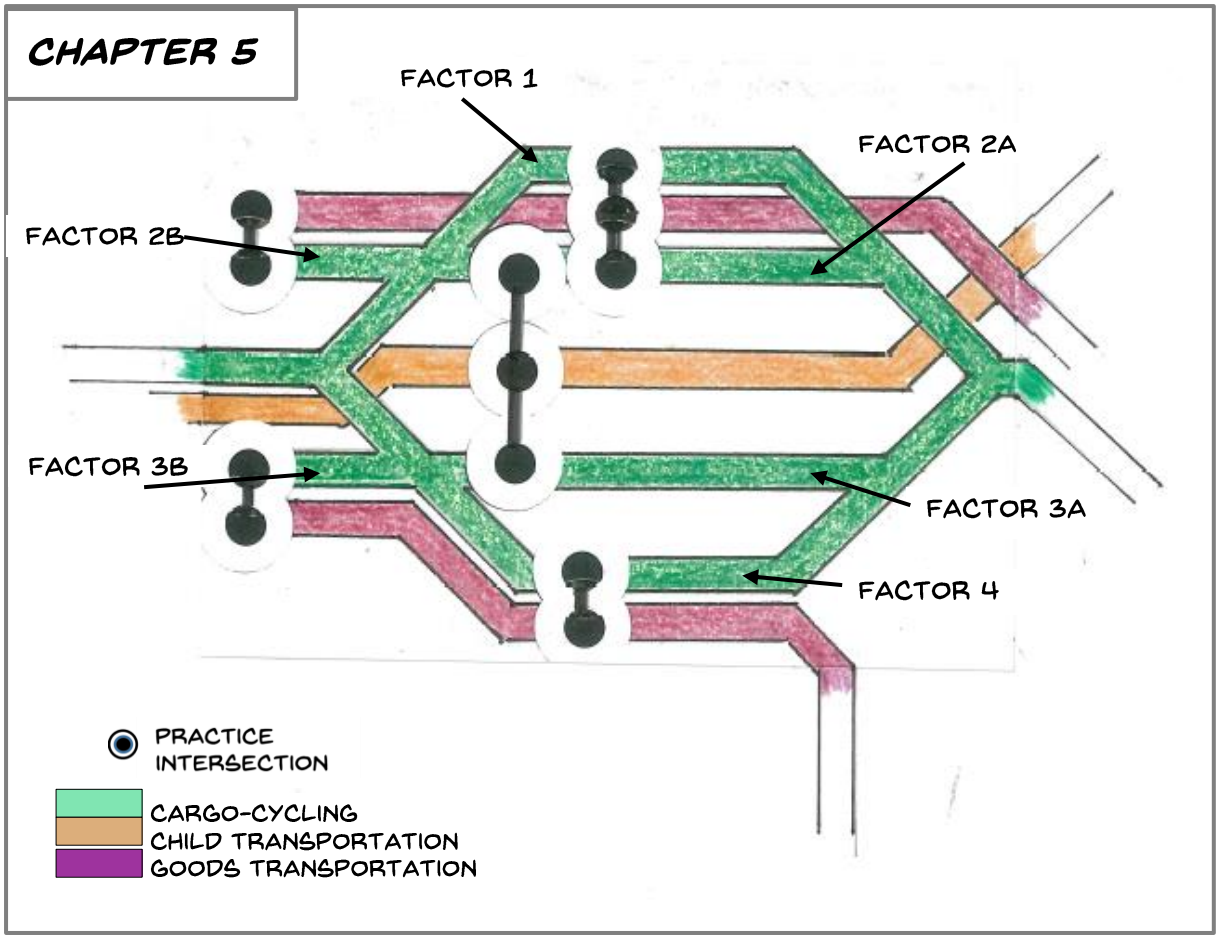



**Figure 5-6 Chapter 5 practice summary**

A further zooming-in on any of the bifurcations or practices would reveal the 3 core elements of cargo-cycling (Figure 4-2), which form in turn a recognisable variant of the broader again practice of cycling. The bifurcation observed only become apparent by zooming-in on cargo-cycling and the practices it co-exists with.

In the next chapter (Chapter 6), the zooming process will continue, attending to the home-building of cargo bikes in Christchurch. Home-building is observed to support the accomplishment of load-carrying practices, involving the transportation of goods and children, in a manner which overcomes the lack of commercially available cargo bikes, and their potentially prohibitive cost for households, often with young families.

# Chapter 6 'It's the cutting things that's the hard part' – the home-building of cargo bikes in New Zealand

## 6.1 Introduction – cargo bikes, practice theory, and home-building

The decarbonisation of mobility can potentially be achieved by people travelling more efficiently, differently, or less (Berger, Feindt, Holden, & Rubik, 2014), but fundamentally decarbonisation will only occur if 'enough people do enough things differently enough' (Watson, 2012: 488). In many European cities, cargo bikes are becoming seen as a valuable means of delivering goods within urban areas, replacing motorised vehicle trips, and thereby reducing energy use, congestion, and greenhouse gas emissions. Cargo bikes - essentially human-powered vehicles capable of transporting payloads up to 200 kilograms - facilitate the doing of load-carrying by pedal cycle, the addition of E-assist technology increasing that capability to 300 kilograms or more. Cargo bikes have a lineage in Western countries that can be traced from the early freight bikes of the 1880s (Cox & Rzewnicki, 2015). Their contemporary use for commercial and domestic purposes, being synonymous with the renaissance of cycling in northern Europe, and particularly Denmark and the Netherlands. In Denmark, such innovation included, in 1984, the launch of the first Christiania cargo tricycle (Figure 6-1), designed and built in the self-styled car-free 'freetown' area of Christiania, in Copenhagen. The manufacturers of this trike consciously aspired to promote cargo-cycling in the domestic realm, to make 'family cycling, including children transport … available in a practical and safe way' (http://christianiabikes.com/en/about-cb/history/). Since that time, cargo bikes have become a popular means of transport for families and individuals, particularly in the cities of Copenhagen and Amsterdam. The City of Copenhagen (2013) reported that 28 percent of all families with two children had a cargo bike, 17 percent owning one instead of a car.

Cargo bikes are now also becoming a more common sight in Western cities outside of mainland Europe. Both *Cycle freight in London: A scoping study* (Transport for London, 2009), and the *Portland City Bicycle Plan for 2030* (Portland Bureau of Transportation, 2010) make specific mention of the need to accommodate the operational characteristics of pedal cycles, such as the increased width of cargo bikes, and their ability to overcome the 'limits on load capacity' imposed by the use of the 'standard bicycle' (Portland Bureau of Transportation, 2010: 14).


**Figure 6-1 Home-built two-wheeled and Christiania three-wheeled front-loading cargo bikes, Christchurch, NZ (left) and Rear-loading (longtail) cargo bike, Portland, OR (right)**

Commercially built cargo bikes cost more than conventional utilitarian pedal cycles. Furthermore, in geographically isolated countries like New Zealand, cargo bike prices also include significant freight costs. As of 2016, it is possible to purchase, direct from a handful of specialist New Zealand retailers several brands of European and US designed complete cargo bikes, cargo bike frames, and an extension kit which can be added to an existing pedal cycle to create a longtail cargo bike. Prices for complete cargo bikes range from around NZ$1650.00 to NZ$6,000.00. Online purchase, from overseas manufacturers, presents a further option. Thus, whilst it is certainly possible to purchase a new cargo bike in New Zealand, it is not a product seen routinely in the showrooms of high street, or 'big box' type pedal cycle retailers. Further, due to the small number of cargo bikes in New Zealand, cargo bikes are rarely available second hand, and when they do become available, good quality bikes fetch prices similar to new machines.

One alternative is to home-build a cargo bike, there being a number of online resources available to support this practice. This study focuses on the practice of home-building cargo bikes in Christchurch, a city which generates more cycle commuting trips than any other city in New Zealand (Statistics New Zealand, 2015). As Aldred and Jungnickel (2013) point out, most people 'make do with what is available … adapting or improving' (p. 616) as they can. In the transnational circulation of cargo-cycling, cargo bikes can thus become what Oldenziel and de la Bruhèze (2012) call 'glocalized … tailored … to fit local laws, customs, user preferences and cultures' (p. 22). For the participants of this study glocalizing involves using welding skills to build their own cargo bikes from new and/or recycled

materials - a process which subsequently allows them to participate in the practice of cargo-cycling.

There are several reasons to empirically study this form of do-it-yourself (DIY) project, and the practitioners who carry out these projects. Firstly, there are few examples from the social sciences of studies of pedal cycles when not being ridden (Aldred & Jungnickel, 2013; Larsen, 2015). Second, in general, there are few studies of DIY practices (Jackson, 2006), and to the author's knowledge, no studies of practitioner's *home-build* pedal cycle projects. Unlike community based pedal cycle projects, where participants "earn a bike" by participating in pedal cycle building and maintenance training (see for instance Community Cycling Center, 2012) and volunteer projects which carry out low cost repairs (Dowsett, 2012) and/or donate refurbished pedal cycles to those in need of them, this research focuses on an amateur, technical (Haring, 2007) productive leisure (Gelber, 1999) practice - individuals building cargo bikes for their own use. This home-building, in contrast to "earn a bike" and community pedal cycle refurbishment schemes is based within the home environment, which becomes a site of production as well as consumption (Maller et al., 2012), involving frame-building from combinations of existing "donor" frames, and new and recycled steel and other components: a 'poaching' of existing materials, rather than starting from scratch (Fiske, 1989, as cited in Franz, 2005). Thus, like Männistö-Funk's (2011) exploration of the history of self-made pedal cycles in rural Finland, this research engages with a precursor to the practice of cargo-cycling, specifically home-building in Christchurch, geographically distant from the epicentre of cargo-cycling in Northern Europe. The purpose is, therefore, to examine the practice of home-building and its relationship to cargo-cycling in Christchurch to meet personal and commercial logistical needs. In analysing home-building, this study draws on two areas of scholarship, social practice theory (SPT), and a body of work which examines activities, such as home improvement and user innovation, within a productive leisure domain.

## 6.2 **Social practice theory**

A number of disciplines including human geography, sociology, science and technology and cultural studies have contributed to the understanding of household consumption, materiality and user innovation. Warde (2014: 279), describes practice theory as a lens with which to magnify 'aspects of common social processes which generate observable patterns of consumption'. Practice theories address the

dynamic relationship between people, things, having, and doing (Horne, Maller, & Lane, 2011; Shove et al., 2007). While theories of practice are diverse (Nicolini, 2012; Schatzki, 2011). Warde (2014) argues this has not undermined their ability to facilitate 'distinctive and defensible theoretical analyses' (Warde, 2014: 285). Practice theorists suggest that the study of practices, defined as empirically recognisable activities, offers 'distinctive and challenging' mechanisms for comprehending the relationship between human action, social order, and change (Watson, 2012: 489). SPT differs from earlier, 'thoroughly social' (Shove & Pantzar, 2005: 44), versions of practice theory in foregrounding materiality (Pristed Nielsen & Møller, 2014), such that emergent objects and technologies are understood to be performatively integrated into pre-existing practice configurations (Magaudda, 2011). An analytically simplified (Christensen & Røpke, 2010: 239) tripartite framework of practice elements (materials, meanings, and competences) is advanced, the elements becoming linked in the performance of a practice by practitioners (Røpke, 2009). However, this linking by practitioners as hosts of the practice does not imply that the meanings and competence are attributes of the individual, but are rather seen to be attributes of the practice-as-entity in which the practitioner is participating, the practice rather than the practitioner ultimately being the focus of attention. Thus, the social is not located in mental qualities, discourse, or interaction, but in the enactment and reproduction of practice (Watson & Shove, 2008). This foregrounding of materiality means that products are 'increasingly viewed as essential ingredients in the effective accomplishment of everyday life' (Watson & Shove, 2008: 69). However, this does not mean that the individual is absent from analysis. Indeed, Reckwitz (2002) shows that in practice theory, the individual as practitioner or carrier of a practice (Shove et al., 2012) holds a distinctive position as the 'unique crossing point of practices' (Reckwitz, 2002: 256). This unique position leads Postill (2010) to suggest that 'practice theory is a body of work about the *work* of the body' (p. 11, emphasis added), the overlapping practices that people perform in the course of their daily lives. For this reason, it is important to include 'social interaction in the analysis of social practices, as in most cases, the successful performance of a practice depends on the active participation of several persons' (Christensen & Røpke, 2010: 249).

Because SPT is interested in the dynamics of practices, it rejects a monolithic unchanging practice entity, instead seeking to account for spatial and temporal variation in performance. As Watson (2012: 490) shows, using the exemplar of

cycling, the entity 'provides the framing, the resources, and patterns for a diversity of performances of cycling', but that entity is understood to be capable of change in at least three ways: in the constitutive elements of the practice, the population of practitioners, and the bundling together of practices.

The extension of emphasis to issues of materiality and social interaction are important components in the home-build process. Here, practice theory is used to investigate cargo bike building projects, where the relationship between three elements, the materials and tools used, the skills, competence or 'know-how' of the practitioner, and the meanings circulating of what a cargo bike is, are of great significance to the success of the project (Watson & Shove, 2008). Different combinations of these three elements will be present in practitioner's projects, and this research investigates the characteristics of several such projects. As shown by Shove, Watson, Hand and Ingram (2007) such projects are transformative of both the materials incorporated within the project, but also have the potential to transform the practitioners 'career' competence and confidence, in taking on future projects.

## 6.3 Accounting for home-building – historical perspectives on productive leisure

Home-building can be understood in relation to the broader literature on what Gelber (1999) refers to as serious or productive leisure. Like studies of hobbies (Gelber, 1999), do-it-yourself (DIY) home improvement practices (Atkinson, 2006; Bix, 2009; Goldstein, 1998; Shove et al., 2007; Watson & Shove, 2008), tinkering with automobiles (Franz, 2005), boat building and renovation (Jackson, 2006; Jalas, 2005, 2009), ham radio (Haring, 2007), craft consumption (Campbell, 2005), user innovation (Franke & Shah, 2003; Hyysalo, Juntunen, & Freeman, 2013), and enthusiast groups (Arsel & Bean, 2013; Muniz & O'Guinn, 2001; Schau, Muniz, & Arnould, 2009), this study engages with the relationships between materials, tools, people, and infrastructure, in this case in the home-build construction of cargo bikes.

Undertaking such activities has not always met with societal approval. While there are no hegemonic definitions of what constitutes a hobby or DIY, prior to the late nineteenth century hobbies were sometimes regarded as dangerous obsessive activities (Gelber, 1999). Understandings changed, and by the late nineteenth

century, serious leisure pursuits, or what Gelber calls the 'oxymoron of "productive leisure"' (p. 6), were valorised as embodying the development of specialist skills and the accomplishment of standards, the rewards gained from perseverance, and subculture membership. According to Haring (2007) by the early twentieth century, hobbies had become 'pursuits distinguished by their association with values such as productivity, educational enrichment, thrift, and the structured use of time' (p. 1), although 'tinkering' (Franz, 2005) with automobiles was less well thought of. Indeed, a 1950s column "The Amateur Scientist" in *Scientific American* magazine described tinkerers as 'individuals "reclusive by nature" who "grow ever more reclusive for fear of being thought mad by non-tinkers"' (Haring, 2007: 8).

In refining the definition of a hobby, Gelber suggests hobbyists 'choose their own projects, acquire their own materials and tools, work at their own pace in their own space, and create a whole object from start to finish … [which] is almost always a representation of a similar object in the commercial world' (p. 156). A subcategory - technical hobbies:

> Must require some technical understanding or skill beyond simply how to operate a technology … each technical hobby has as its focus some machine or apparatus, but this characteristic is not sufficient for a hobby to be termed technical (Haring, 2007: 2).

The core distinction here seems to be that the technology must motivate the pastime and engage the hobbyist, rather than be a means of achieving a non-technical end-product. Thus, whilst making an occasional pedal cycle repair in order to save money or expedite use of a pedal cycle may involve skilled use of technology, by Haring's definition this is not partaking of a technical hobby.

DIY activities are often categorised as hobbies and are most commonly associated with home improvement. Studies illuminate the relationships between 'design, domestic life, consumer culture, and the history of technology' (Goldstein, 1998: 12), although attention tends to be on the material outcomes of the activity (see for instance Attfield, 2000), rather than what Jackson calls the 'significance of the making experience' (2006: 058). Atkinson (2006) characterises DIY as consistent with the democratising of decision-making, freeing from work based supervision, and releasing people from the 'grip of professional tradesmen [sic] and skilled artisans' (p. 6). According to Franz (2005: 11), tinkering was an 'act of creativity and emulation … those who became grass-roots inventors relied on spatial thinking and "fingertip" knowledge rather than formal education or training in science and engineering' and

were sometimes able to capitalise on their ingenuity, producing commercial automotive accessories. In DIY, practicality is argued to be more important than creativity, rendering it 'structurally different' to other hobbies (Gelber, 1999: 269). DIY is understood by Attfield (2000: 209) as a subculture which 'can exist in its own right rather than as a poor copy or reproduction of the real thing', hybridising 'proper' but disparate material elements to allow infinite variation within a recognisable style.

An alternative conceptualisation of productive leisure – craft consumption (Campbell, 2005) - describes a process where 'individuals both design and make the products they themselves consume … that may … consist of several items that are themselves mass-produced' (p. 27). Thus, unlike the concept of craft production valued by William Morris and Karl Marx, Campbell's craft consumption is inseparable from the mass consumption of retail goods, that form the 'raw materials' (p. 28) for new products that are used by the maker. For Campbell, craft consumption usually includes a 'marked element of skill … creativity and self-expression … [in which] the worker is in control of … [any] machine' (p. 28) rather than the machine being in control of the worker. Campbell points to the importance of power tools to DIY projects as a form of re-appropriation of machines, a competence with the machine rather than a loss of autonomy by craft consumers. Goldstein's (1998) offers an opposing viewpoint suggesting that the built-in professionalism of power tools vests the skill in the machine rather than the operator. He points to the post-World War II years as a time when a number of new products such as power drills, had 'professional skills designed and built into them' (p. 47) putting a wider range of DIY tasks within the sights of non-specialists.

Shove et al. (2007) argue, that competence in DIY projects can be usefully thought of as distributed between practitioners, materials, and tools, with acquiring knowledge or competence being a central attraction of such pastimes (Leadbeater & Miller, 2004). Initial design is argued to take a pragmatic trial and error approach (Jackson, 2006), and practical expertise is also seen to make its way through informal networks of friends (Campbell, 2005; Watson & Shove, 2008) which may contain 'expert' amateurs (Franke & Shah, 2003; Shove et al., 2007) or 'pro-ams', defined by Leadbeater and Miller (2004) as 'innovative, committed and networked amateurs working to professional standards' (p. 9).

Growth in practical expertise is found to be aided by the growth of dedicated magazines, television programmes, and books which support the knowledge acquisition of amateur experts (Campbell, 2005; Franz, 2005; Gelber, 1999; Goldstein, 1998; Haring, 2007). Hyysalo et al. (2013), in analysing the sophisticated DIY competences and projects of Finish users of home energy heat pump and wood pellet heating technologies, find that user run internet fora facilitate competence by sharing professional skills. Franke and Shah (2003), in their examination of sports enthusiast user-innovators, pay specific attention to members of voluntary special-interest communities, who draw on the collective knowledge of members' of their communities for information and assistance in the development of their ideas. They find that such innovation relies on the community for support and advice, and is repaid by the sharing of subsequent innovation. This conclusion mirrors findings from the communities of practice literature, which finds considerable learning and innovation takes place in informal communities of practice, formed through previous and ongoing interaction and experience (Brown & Duguid, 1991), 'bound together by shared expertise' (Wenger & Snyder, 2000: 139), and 'sustained pursuit of shared enterprise' (Wenger, 1999: 68). This point is reinforced by Christensen and Røpke (2010), when they point to the importance of including social interaction when analysing social practices, because of the common requirement for active participation of several persons. Franke and Shah (2003: 173), found that user-innovators got fun and enjoyment through task engagement, and their strongest motivation from helping and supporting others in the community: a generalised exchange system for social rather than personal benefit.

## 6.4 **Methodology**

The data discussed below draws primarily on in-depth interviews conducted with a purposively selected sub-group of cargo-cyclists in Christchurch[17], with experience of home-building cargo bikes. As Hitchings (2012: 66) shows, interviews are an efficient mechanism for understanding 'how it is to embody certain practices'. Where possible, interviews incorporated a guided 'tour' (Shove et al., 2007) of the cargo bikes, providing insights into the origins and accomplishment of the project. In total, seven interviews were undertaken with practitioners building their own pedal cycles, helping others to build pedal cycles and/or building pedal cycles for others. Participant observation of the first Christchurch cargo bike race has been

[17] Identified as participants CH3, 4, 6, 7, 9, 10, 12, 13 and 15.

incorporated, and in addition, two websites which provide cargo bike-building instructions, and two blogs which report cargo bike building projects in Christchurch are drawn upon. Empirical analysis was conducted using a three stage iterative process of thematic analysis (Lee, 2015; Riessman, 2008) involving data condensation, display and conclusion drawing (Miles et al., 2014; Spencer et al., 2003). These methods facilitate a focus on sayings, doings and artefacts as a means of examining practices (Nicolini, 2009b; Yli-Kauhaluoma, Pantzar, & Toyoki, 2013), allowing what Lave and Wenger (1991: 68) call 'talk about social relations in which persons and practices change, re-produce, and transform each other'.

## 6.5 **Home-building**

The following sub-sections explore the practice of home-building in Christchurch, focusing on inspirations, building techniques, and the affordances of the end product. Home-building is considered under a tripartite structure, focusing on the elements, practitioners, and complexes forming around the homebuilding of cargo bikes.

### 6.5.1 The elements of home-building

Like Shove et al. (2007), this research takes seriously the idea that 'products are actively implicated in the configuration of skill, in framing what people are willing and able to do themselves' (p. 42). All the home-build practitioners interviewed for this research already practiced cycling for utility, and in many cases also for leisure pursuits, in other words, they were already recruited to cycling. Further, each practitioner was either an 'expert' amateur or had access to one or more 'expert' amateurs with TIG welders and welding skills, within their network of associates. CH6, for instance, had previously built a wind-generator using arc welding but for his cargo bike made use of CH9's TIG welder, which is 'completely different' to arc welding, although 'it's not that hard to learn'.

CH6 and CH9's perspectives on TIG welding, relate to Campbell's (2005) views on re-appropriation and competence with using machines, confirming the importance of power tools to DIY projects. CH9 likes building, bikes and has now built four of his own as well as helping others with projects. After 'quite a bit of homework', he specifically purchased new TIG welding equipment to indulge this interest, justifying the cost against the price of the specialist pedal cycles he no longer needed to purchase commercially. According to CH9, it is now 'pretty hard to get a bad TIG welder, even the cheapy ones are now lots better than the ones from 15 years ago',

suggesting a more modern vesting of skill within the machine (Goldstein, 1998). CH9 taught himself to TIG weld with the help of library books:

> The thing that surprised me, welding is really pretty easy, it's not the big deal, it's the cutting things that's the hard part … I took an awful lot of time working out the right shapes.

In this way, cutting competence becomes part of welding competence, accurate welding being dependent upon cutting competence.

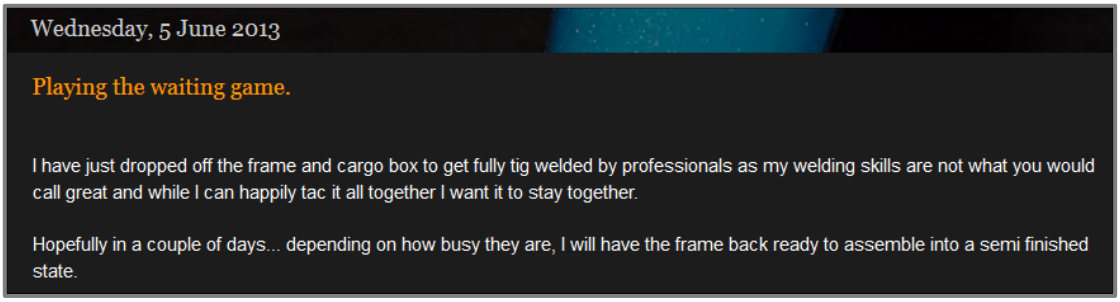
CH13 welds as part of his job and has a small TIG welder at home. As well as building two cargo bikes, he does aluminium welding jobs for others, including welding bike trailers and helping CH12 build a proto-type cargo bike. CH3 also has his own TIG welder and learned to TIG weld at polytechnic, although he could already gas weld. He thinks you need to keep practicing to improve your skills, so having ongoing welding projects is helpful. CH3 has nearly completed a cargo bike and did most of the welding for CH4's cargo bike. Similar to CH13, CH10 has acquired welding skills from previous jobs including furniture making. However, CH10 is adamant that anyone can weld, and build bikes if they understand the process.

Welding competence it transpires is not the only form of competence required, with the quality of preparation being important. As CH9 identifies, for TIG welding, the gap between the tubes to be welded together matters. With long lengths of larger diameter tubing, 'the angle of the cut has to be right' with big gaps using 'lots of gas' and creating 'big ugly welds'. CH6 was happy to not follow a plan, instead taking the advice of an expert amateur: the 'main thing was to get it [the frame] straight and the head angle on the front needed to be right … guesswork turned out about right.' He admits to producing the 'pretty dirty ugly welds' that CH9 cautions about, and 'checking welds for cracks from time-to-time - nothing's broken down on it at all yet!'

CH4 did draw a plan for his cargo bike, 'for sizes & angles and did all the cutting from that'. He did all his own preparation before taking it all to CH3's where they jigged-it-up and CH3 did the welding. Like CH9, CH4 found shaping the tubes for jointing to be 'quite a mission', requiring the use of a tube notching program, available online. Without access to tools such as mills he used a hacksaw, and did all the shaping of the joints with a course half round file: buying a new file 'made a big difference'. CH10 uses another technique, he acquires sandpaper off-cuts via a friend and uses them on his lathe to shape the cut steel to shape before welding.

This makes the welding much easier as his welding equipment is 'pretty old & worn out'.

A distinction is therefore made between the welding and preparation processes, with most participants emphasising the contrast between the skill and attention to detail required for accurate preparation, and the relative ease of acquiring welding skills, particularly given access to more modern equipment and the opportunity to practice those skills. In this sense, technological improvement could be argued to have to some extent redistributed competence between the practitioner and the technology (Shove et al., 2007). Participants who have deliberately developed their welding skills prior to bike building, fit an expert amateur typology, while others are willing to accept adequate, if ugly, welds if they prove to be functional. A third set of home builders show evidence of a different form of competence distribution, taking on preparation work, but as shown in this excerpt from a New Zealand cargo bike building blog (Figure 6-2) handing over the responsibility for welding competence to other expert amateurs or even professionals. Thus, varying forms of competence distribution are evident in the participants, ranging from conceptions of ensemble activity in craft consumption (Campbell, 2005), and Atkinson's (2006) view of the democratisation of decision making to Goldstein's (1998) vesting of professionalism in the power tool. It is clear that knowledge is circulating within the informal and overlapping networks of these practitioners.


Wednesday, 5 June 2013

Playing the waiting game.

I have just dropped off the frame and cargo box to get fully tig welded by professionals as my welding skills are not what you would call great and while I can happily tac it all together I want it to stay together.

Hopefully in a couple of days... depending on how busy they are, I will have the frame back ready to assemble into a semi finished state.

**Figure 6-2 Playing the waiting game**
(source: http://cargotrike.blogspot.co.nz/search? updated-min=2013-01-01T00:00:00-08:00&updated-max=2014-01-01T00:00:00-08:00&max-results=14)

CH13 has built what he calls a very basic three wheel cargo bike with materials he had to hand. In is a very light construction which means that he can easily lift it over obstructions. Commonly, cargo bikes are built for strength and are therefore heavy and awkward to lift. CH13's light weight frame coupled with light weight components salvaged from other bikes means that transporting his two children pushes it to its

limits. Most home builders use donor bikes for much of the frame construction (Figure 6-3).

Using a home-built cargo bike and trailer, CH10 collects donor steel bikes thrown out from big box non-specialist retailers, that are 'so badly assembled that they fall apart very quickly' and so are returned to the shop. He combines these donor frames, with other salvaged steel in his building projects. CH9 makes it clear that appropriate use of donor frames is important for the ultimate strength of the cargo bike, including 'being careful to keep the butted [thicker] part of the tube'. CH12 has built two 3-wheeler cargo bikes of robust design and has found it beneficial to incorporate higher specification components in his second build, including improved brakes and stronger wheels.

**Figure 6-3 The combining of re-used products with new materials in cargo bike building projects in Christchurch**

It is argued that information and communication technologies are 'a new "normality" in everyday life' (Christensen & Røpke, 2010: 233). Indeed, it would be relatively uncontroversial to suggest that the internet has generated multiple opportunities for establishing relationships, virtual communities of interest or practice, and widening the 'social space' of many practices (Røpke & Christensen, 2013: 61). However, in some senses this electronic access to information also represents a dematerialisation of material objects (Magaudda, 2011) where for instance it is possible to find out how to build a cargo bike by following step-by-instructions found on websites, follow the construction of other people's home-build projects on blogs, and watch online instructional welding videos. As Magaudda (2011) makes clear, dematerialisation has a paradoxical relationship with materialisation, whereby reconfigurations of relationships between materials and cultures, which show evidence of dematerialisation, lead to new materialisations, in this case, the construction of an artefact, the cargo bike. Arguments supporting the use of cargo bikes to replace car journeys, potentially support a further dematerialisation where car ownership or use may be reduced.

CH10 has made extensive use of internet based resources such as *Tom's Cargo Bikes* (Figure 6-4) which provides an album of basic steps to build a cargo bike from new and reclaimed materials. Another source is the website *Atomic Zombie* which produces downloadable guides such as basic welding instruction (Figure 6-5) and bike plans which can be purchased and downloaded (Figure 6-5).

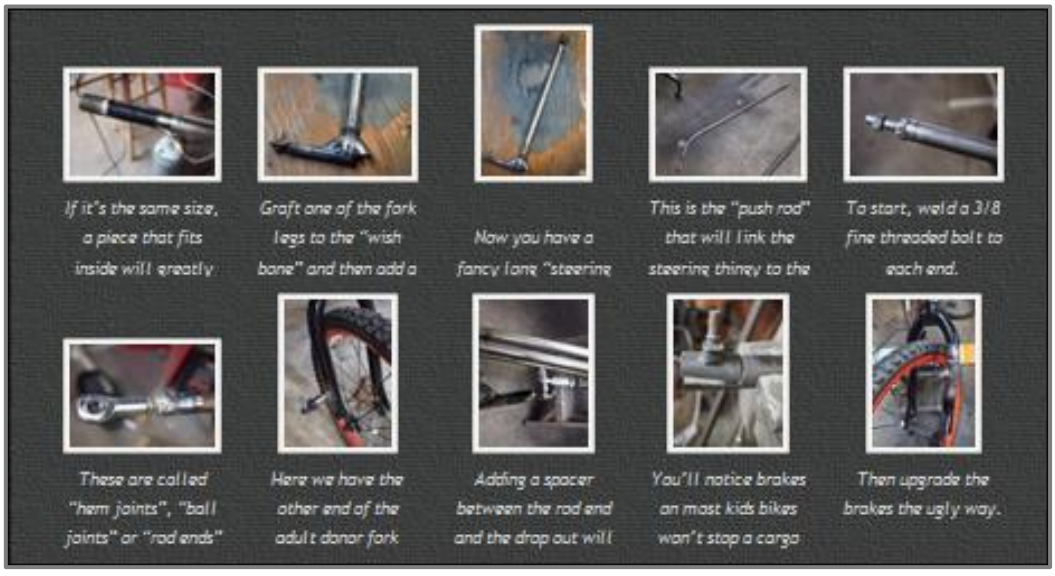



**Figure 6-4 Build your own instructions from Tom's Cargo Bikes**
(source:
http://tomscargobikes.com/tomscargobikes.com/BUILD_YOUR_OWN/Pages/BUILD_IT.html)

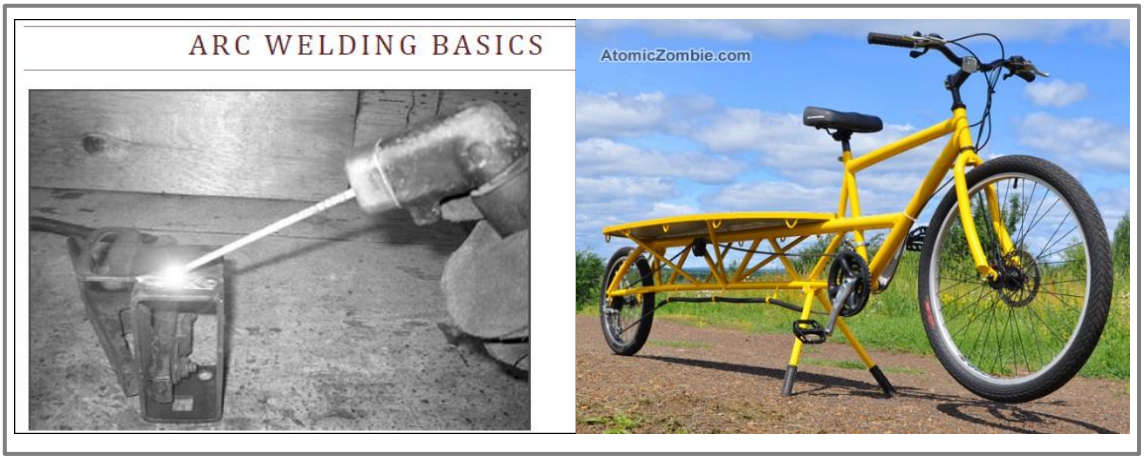



**Figure 6-5 Instructions available to download or purchase from Atomic Zombie**
(source: http://www.atomiczombie.com/)

CH4 did not like the home-build plans available on the internet and instead based his design upon commercially available cargo bikes, advertised and reviewed on the internet. CH4 chronicled the design and build process in a blog which itself has becomes a source of information for other homebuilders. As CH15 points out on his blog (Figure 6-6), You Tube videos present another source of distributing competence via technological means.

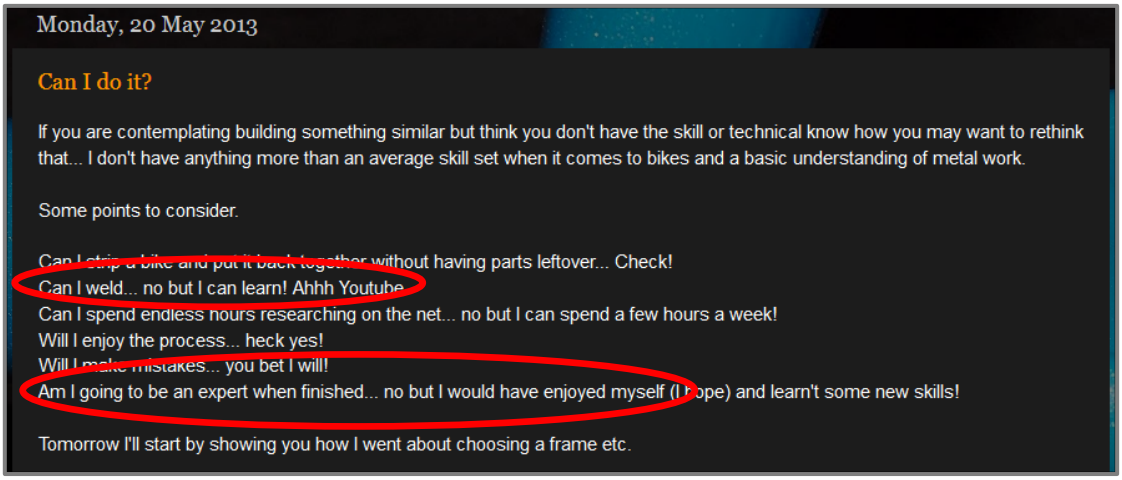



**Figure 6-6 Can I do it?**
(Source: http://cargotrike.blogspot.co.nz/search?updated-min=2013-01-01T00:00:00-08:00&updated-max=2014-01-01T00:00:00-08:00&max-results=14)

Welding and bike design knowledge was also distributed by less digitally reliant means: CH9 learned to weld from books, CH3 attended a polytechnic course to diversify his welding skills, and CH10 and CH13 learned welding skills in the course of their working lives. CH6 used some pre-existing knowledge, and CH9's expertise and equipment, to allow him to weld his own cargo bike. Photographs of other

people's cargo bikes provoked interest and inspired the design of many of the cargo bikes built by the participants. CH13 based the design of his three wheeler cargo bike on a photograph of a cargo bike belonging to a friend of CH12's. A number of participants also pointed to articles in a cycling activist's magazine as inspiration.

### 6.5.2 Home-build practitioners

For a practice to persist there must be ongoing recognisable performances of the practice-as-performance, filling out and reproducing the practice-as-entity. For this to happen, the linkages between the elements must be continually re-made by practitioners as the carriers of practice (Shove et al., 2012). The practice must, therefore, attract new, or retain existing committed practitioners (Shove & Pantzar, 2007). Thus, for the practice of home-building cargo bikes to persist, existing practitioners must continue to home-build or new practitioners must be recruited to the practice. This requires successive commitments of equipment, skill, time and money (Reckwitz, 2002).

The mechanisms for recruitment are varied, from the interpersonal to magazines and the internet, and relate to the 'possibilities' (Shove & Pantzar, 2007) that home-building affords. The home-build practitioners that took part in this research largely learned by doing (Haring, 2007) exhibiting self-confidence, cultural capital and reflexive awareness (Shove et al., 2007). The more 'expert' amateurs display ongoing commitment to home-building as a hobby, or as a hobby-business, forming an additional income stream and/or a means of promoting cycling. For others, home-building is a means to an end, a financially advantageous (Haring, 2007) way of ascertaining whether a cargo bike can be usefully integrated into daily practices. Having achieved this goal, elements of the home-build experience will remain in circulation as resources for others, but will not necessarily generate another personal home-build project.

CH9, CH10, CH12, CH13, and CH3 are all keen to build more cargo bikes. CH9 can imagine building bikes for people in the future 'but I don't think it would be a commercial thing … I wouldn't enjoy it, it has to be a hobby rather than a job'. CH3 intends to help a work colleague build a bike and CH4 has thought in the past, before having children, about building bikes one day per week with CH3, with minimal capital outlay, and thus not needing to make a profit.

CH13's involvement is to some extent dependent on the success of the proto-type he is producing with CH12. CH12 has been building and selling aluminium bike trailers for a few years because he is keen to find ways to support people to minimise their car use. Having built several cargo bikes he says 'I don't think the market is big enough in New Zealand to make it a full time job, so it'll always be a hobby business', however, if cargo bikes do become more popular, he would be interested in building more of them:

> because I think that there's a lot of things that you can do with a cargo bike that you can't do with a two wheeler, the three wheelers … are very popular, particularly for parents because you have got the kids in front of you which is better.

CH10 continually builds bikes to meet his needs and would like to either build cargo bikes for people or teach them how to use tools to build their own pedal cycles.

For the practice of home-building to persist it, therefore, relies on a circuit of reproduction (Pantzar & Shove, 2010a), supporting the persistence and growth of cargo-cycling. As shown above, the cost of purchasing a new commercially constructed cargo bike is relatively high in New Zealand. By contrast, CH6 thinks his bike cost about NZ$150.00 to build. CH3 first saw a longtail cargo bike, which gave him the idea to build, as an 'off-the-shelf nicer cargo bike costs quite a lot of money and is hard to justify'. The relatively low cost of home-building, therefore, points to the persistence of this practice, as an alternative to off-the-shelf purchase, but only if recruitment and retention of practitioners to the practices of cargo-cycling, and home-building, can remain at a higher level than defection from the practices.

Cargo bikes are used in a number of integrative projects (Christensen & Røpke, 2010) such as shopping and transporting children. Thus, it is possible to say that practices of cargo bike home-building coexist with practices of shopping, child transportation, and so on. In this situation practices are mutually beneficial, constituting 'a practice complex or system provisionally held in place by loops of positive feedback, and/or other forms of interdependence' (Pantzar & Shove, 2010b: 458).

### 6.5.3 The rhythms of home-building

SPT understands relations between practices to be based upon the emergent and contingent performance of practices to meet need in daily life (Pooley, Horton, et al., 2011; Watson, 2012). It seeks to move beyond detailed studies of situated localised practices and their reproduction, to investigate how 'networked practices condition

the sequential order and synchronicities of everyday life' (Pantzar & Shove, 2010a: 20). Rhythms can be understood, as bundles of achievement of the coordination and stabilisation of practices (Shove, Trentmann, & Wilk, 2009). Southerton (2013: 335) argues that the 'temporalities of practices represent an instructive analytical theme for developing understanding of everyday life, consumption and particular forms of human action', with Walker (2014b) suggesting three categories of temporal dynamic for examination – change, rhythm, and synchronicity. Pantzar and Shove argue that such an approach requires a methodology capable of considering how practices are linked together in interactive, coordinated and dynamic bundles, and how collective temporal orders impact individual practices.

CH6 knew about longtails but wanted to build his front-loader because such a bike 'wasn't really available, and it looked like a fun project. It would also be good for transporting a baby, using a car seat in the box, so you are able to see the child and they are looking *at* you. The cargo bike is not the most used bike in the shed, but for CH7 it is the most used bike as she 'can't go anywhere without the kids … it has a specific purpose and it works really well for that purpose'.

In his blog CH15 says:

> Since having our first child I could see the benefit in riding a cargo bike, so that's my focus, for now, building a cargo trike'. Seeing as though I have never ridden or even been up close to a cargo trike I can only loosely base my decision on others reviews and their experiences with them, along with my own ideas and thoughts on how these things might work in reality… As I intend on putting my son in the front and tootling him around town, stability, safety, and handling were probably my number one concern followed by cargo space and looks (http://cargotrike.blogspot.co.nz/).

CH4 had recently had a child when he saw a picture of a cargo bike and thought one could useful. 'We've got a single wheel trailer that a friend built and I'd been using that for doing grocery shopping and things, either that or a banana box on the carrier, but with a cargo bike I thought it would be so much easier'. The child first travelled on the cargo bike in a capsule, then a rearward facing seat similar to those found on the rear carriers of conventional bikes, and then on a seat built into the box with a seat belt.

CH3 chose to build a longtail, as at that time he had not seen a front-loader; he thinks a front-loader will probably be a future project to be used for shopping and carrying his child. CH10 used to have a child trailer, but he prefers the contact you

get with the children when they are on the bike. Before starting a family CH9 found a conventional bicycle could meet his load-carrying needs but:

> It's not just the baby, you need to be able to carry all the other paraphernalia, and if you want to go and get groceries and things … the ideal baby carrying solution would be a front-loader type bike, but I think that in the long term I'll get more use out of a longtail, just because I'll use it for cycle touring and can take it off road if I want to. The sorts of things I'm likely to do'.

Thus for CH9 the choice of cargo bike design to build is pragmatic, based upon current and future circumstances, affording a long-term commitment to the use of a cargo bike, even when combining child transportation with other activities, is no longer the main consideration.

CH12, with expertise gained from building bike trailers, felt the cost of a new cargo bike to be 'prohibitive' but that building one would provide a stable and practical means of transport for large heavy loads. Before building his longtail, CH9 had seen other longtails, but not in Christchurch, and 'always felt it would be rather cool to have one'.

Just as the know-how, meanings, and materials link together as the components of the performance of home-building, home-building for the practitioners in this study, is one practice component in a network of practices which centre round achievement of load-carrying activities. This is a cooperative beneficial relationship between practices. The majority of practitioners in this study need to combine the load-carrying of goods, with the transportation of young children.

## 6.6 **Synthesis, implications, and conclusions**

The home-building of pedal cycles is not a new activity. Some histories of cycling acknowledge the impact of tinkering by 'handymen [sic]' (van der Plas & Baird, 2010: 12) and self-made pedal cycle building (Männistö-Funk, 2011), although the shaping of technology by political, socio-cultural, and economic forces is often underplayed in linear narratives of technological progress (Bijker, 1995; Cox & van de Walle, 2007). Analyses informed by practice theory, both challenge linear narratives, and the value of studying artefacts in isolation, instead calling for consideration of technology, such as the rickshaw, based upon what people *use,* rather than what is invented (Edgerton, 2007). To be useful, an object such as a pedal cycle needs to be brought into a relationship with other objects, and social-cultural relations, in a

'human-thing experience' (Jackson, 2006: 58): SPT explains such configurations, as links between materials, competences, and meanings (Shove et al., 2007).

Home-building in Christchurch reflects a process of linking and hybridising at a number of levels: a distribution of competence across 'complexes of tools, materials, intermediaries, and human beings' (Shove et al., 2007: 143). The homebuilders interviewed, combine the repurposing of pre-existing material resources, such as the reject pedal cycle frames CH10 collects, with new and reclaimed materials from other sources: hybrids of materials produced in large-scale industries with the small-scale and local (Edgerton, 2007). As a consequence, competence becomes an emergent 'relational attribute … [of] performative relations between human and non-human actors (Shove et al., 2007: 143). This is a competence, both in relation to home-building, and a competence emergent from subsequent incorporation of the home-built cargo bike, into load-carrying practices.

The skill of cargo bike building is captured within a practice theoretical focus on consumption (Watson & Shove, 2008), but absent in perhaps more familiar representations of consumers as rationally acting individuals, dupes of market forces, or postmodern identity-seekers (Campbell, 2005; Watson & Shove, 2008). The idea of craft consumption, as an ensemble activity where rather than choosing to purchase an 'off the shelf' (Campbell, 2005: 33) or bespoke manufactured product, the craft consumer, as knowledgeable actor, both designs and makes an identifiable assemblage. In this distribution of competence (Watson & Shove, 2008), the idea of assemblage resonates with conceptualisations of human practitioners, non-human materials, and tools as hybrids (Latour, 1997, 2000), with capabilities which in sum are greater than the capabilities of the practitioners or tools, with competence distributed between the practitioner and the tool (Watson & Shove, 2008).

Further hybridisations can be observed, in the configuration of skills between the practitioners, the tools and equipment used to construct the cargo bikes, and the sharing of skills between this small group of home-builders. Attfield (2000) points to individual and group identity gained from 'designing and making the material world' (p. xiii). Four of the practitioners in this case study identify proficiency in TIG welding, either self-taught or gained as a result of college or work-based training. These individuals have become resources within their community of interest, both in terms of know-how, but also as a means of accessing a TIG welder. Whilst such

equipment is observed to have become affordable and reliable, resource sharing for these practitioners appears to be one of the enablers of the projects. The reliability and ease of use of modern TIG welders – the professionalism they embody - is clearly an enabling factor in the projects included in this case study, with some practitioners expressing surprise at the relative simplicity of the welding process as compared with the accuracy required in the cutting and shaping of cycle tubing, particularly if the practitioner wishes to achieve a tidy, professional looking finish. Competence requirements appear to alter or relocate, as product and tool availability increases, seen in the simplicity of purchasing a new file or accessing tube notching programmes on the internet which, while TIG welders embody competence within the human thing relationship.

The distribution of competence between multiple actors and materials has implications for division of labour and systems of provision of knowledge, competence, and product and service markets. Each practitioner, in their performance of the practice of home-building, combines different combinations of materials, know-how, and meanings of what it to fashion a cargo bike adequate to their needs. The distribution of competence between inventive users and the materials they work with, and the projects they work on, has the potential to impact technical evolution and perhaps even local market development (Hyysalo et al., 2013) or the "glocalizing" (Oldenziel & de la Bruhèze, 2012) of cargo bikes, challenging existing mobility practices, or potentially generating new practice configurations and performances (Walker, 2014b). As Franz (2005) shows in her study of tinkering, small changes in technology, brought about by tinkering activities, challenge dominant ideas concerning who can access and have power over technology, blurring the boundaries between invention and consumption. There is no doubt users play a part in product innovation, as can be seen for instance in the development of free open-source software (Leadbeater & Miller, 2004; Pantzar & Shove, 2010b) and innovations in sports and leisure products (Franke & Shah, 2003; Shove & Pantzar, 2005). In Christchurch, that innovation responds to and is part of a glocalizing to local post-earthquake road and resource conditions. Further, as manifest in Christchurch, user innovation is often characterised by sharing and reciprocity, and contribution to a common community of practice (Pantzar & Shove, 2010b).

The literature on the history of DIY cultures and practices largely presents DIY activities as a democratisation of technological competence, a self-driven and

directed amateur design and making process, which if not carried out by the user, will occur in close proximity to the user (Atkinson, 2006). For some practitioners, building, rather than purchase, appears to be a lifestyle choice, a form of physical labour as leisure activity, rather than financial necessity (Goldstein, 1998: 11). For many, there are clear indications of pro-active creative design involving the fashioning of raw materials, and combinations of pre-existing components for the pleasure of personal achievement, an enthusiasm for the grass-roots remaking of technology (Franz, 2005). The challenge of designing and building cargo bikes from tubing and donor frames may, to some extent, motivate the activity, rather than just being a means to an end (Haring, 2007). As identified by Jackson (2006), there seems to be a connection between the constructing and maintaining of the artefact, and the pleasure and utility gained from using it, with home-builders keen to describe and show-off their pedal cycles. For these home-builders, the resources embodied in the collective know-how of the individual and their friends, and the printed and internet based guides and programmes, allowed the conceptualisation, planning, and fashioning of the cargo bikes, at close proximity to the practitioner, even when the bulk of the welding is accomplished by someone else.

DIY activities have been suggested to be a 'leveller of class' (Atkinson, 2006: 1), although Haring (2007: 4) points to the 'general consensus among casual and scholarly observers' that technical hobbies remain largely practiced by men. The actual home-builders interviewed in Christchurch were all working age men with young families. The decision to embark on a home-build project was often associated with the addition of young children into the load-carrying mix, previously achieved by these practitioners using conventional bicycles with the addition of various forms of boxes, bags and/or trailers. Thus change in material circumstances demands a change in load-carrying practices. For these practitioners, achieving load-carrying by cycling rather than driving, walking or making use of public transport is normal. Home-building is one response to the need to assimilate an additional activity (child transportation) into their existing suite of mobility practices. CH6, for instance, estimates the construction of the family cargo bike to have cost NZ$150, including the purchase of two 'donor' bicycles from a recycling centre and plywood for the box. At a time of increasing pressure on household budgets induced by increasing household size, building a cargo bike, while it may not be a financial necessity (Atkinson, 2006), nevertheless, imposes less of cost on a household budget than the purchase of a new commercially produced model.

Seeing home-building as a response to temporal change in household circumstances is one aspect of the temporality of practices and their inter-relationships. Rhythm, understood as repetition or beat over daily, weekly, seasonal or episodic timescales (Walker, 2014b) can be observed in mobility practices. Synchronicity is closely related to rhythm, being the level of matching between the rhythms of activities at a social/societal level, or in relation to the intersection of social and natural rhythms. The practitioner accounts suggest that the birth of a child, the subsequent need to transport children, and the integration of such activities into pre-existing practices, disrupts pre-existing mobility rhythms and the synchronicity between those rhythms, with implications for mobility practices. Load-carrying has to be matched to the demands of an evolving set of interacting practices, the conjoining of activities requiring, for these practitioners, the integration of an alternative material element in the load-carrying activity accomplished by cycling. Home-building projects thus make sense of temporal flow and orchestrate and interweave complexes of practices, often generated by external life-course events.

SPT argues, that rather than a practice travelling in time and space, the elements of that practice travel, to be combined in a manner reflecting local resources, meanings, and competences. However, previously unknown or un-practiced activities need a mechanism to become part of practitioners lives, and first exposure may well hinge upon a chance encounter (Shove & Pantzar, 2007), such as a photograph or magazine article. The practice of home-building of cargo bikes in Christchurch, can both be understood as the sum total of the performances achieved (Schatzki, 2009) and as an ideal-type template receiving attention in individual performances (Reckwitz, 2002). Thus, while the home-built cargo bikes in Christchurch would be recognisable as cargo bikes if for instance transported to Copenhagen, the specifics of design, materials, and know-how, and ultimate use will reflect the glocalization of local conditions. Builder and user innovation in Christchurch, particularly if shared on social media, also impacts the development of home-building-as-entity in an international sense, as the elements of home-building found in Christchurch continue to travel. If the collective trajectories of complexes co-evolve through performance, and each performance changes the conditions for future integrations (Shove et al., 2007: 148-9), then homebuilding contributes to the visibility of cargo-cycling as a load-carrying practice. As a means of achieving activities normalised as requiring driving, home-building becomes one practice within a constellation of

activities that potentially reinforce the visibility, and viability, of achieving load-carrying activities by pedal cycle.

Home-build projects are shown to be an iterative, dynamic process of interaction between people, tools, intermediaries and materials (Shove et al., 2007: 144). Both the practitioner and the materials are transformed by the project, skills may or may not be developed, and the artefact will be differently successful, thus configuring future conditions of possibility including defection. Thus, '*projects, formed of interrelated sets of practices, have emergent consequences for the accumulation of competence and for the careers of practitioners involved*' (Shove et al., 2007: 144, emphasis in original). Economic incentives may not be deemed necessary if an activity is 'rewarding in and of itself' (Franke & Shah, 2003: 174). The practitioner accounts suggest home-building combines the 'serious fun' (Shove & Pantzar, 2007; Stebbins, 1982) of learning and honing skills, with an economically advantageous solution to maximising opportunities for cycling, even in the face of temporal changes in the rhythms of households.

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## 6.7 **Practice summary**

The visual representation of the practice dynamics zoomed in upon in Chapter 6 (Figure 6-7) presents the relationship between home-building, cargo cycling, driving, and child transportation, with each practice being brought into close proximity with the other. Reflecting on the findings from this chapter, the dominant practice of transporting children by car reflected in the practice integration is challenged by the completion of home-building projects which facilitate a reconfiguration of practice relationships. This reconfiguration changes the practice dynamics to allow practitioners to use cargo-bikes to transport their children based upon the building of a cargo-capable bike, and a new congealing of practices surrounding the routines of load-carrying is practically brought together, but not necessarily permanently stuck together, in space and time (Nicholls & Strengers, 2015).

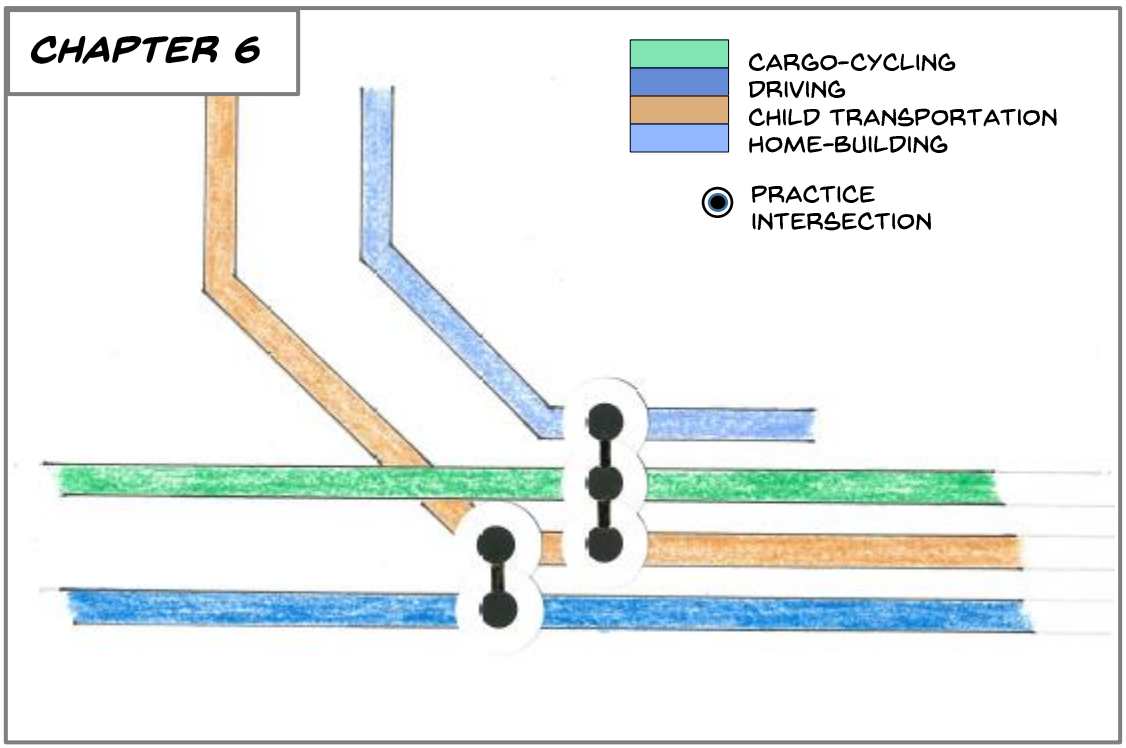


**Figure 6-7 Chapter 6 practice summary**

In the following chapter (Chapter 7), attention turns to Portland where, as part of the annual festival of cycling,the first Disaster Relief Trials (DRT) were organised in 2012. Zooming in on the DRT, not only revealed to the researcher the diversity of cargo-capable pedal cycles to be found in a city, which shows recent, enthusiastic adoption of cargo-cycling, but also the community focused activism that form part of a cycling response to disaster preparedness.

# Chapter 7 To 'prove the grace of a cargo bike and … the oafishness of a truck' - using disaster relief trials to showcase the utility of cargo-cycling

## 7.1 Introduction

The Disaster Relief Trials (DRT), a cargo cycle 'agility trial' based around a post-earthquake disaster response scenario, started in Portland in the US state of Oregon, and have since been replicated in at least five other American and Canadian towns and cities. In the context of the practice of cargo-cycling in Portland, here I take the first DRT, held in June 2012, as a case study to discuss the significance of indirect activism, in the context of Birtchnell's (2012) conceptualisation of how system change can be brought about against a dominating practice consensus. The DRT is here characterised as a form of non-confrontational indirect activism (Pink, 2008a), based around 'celebratory events … through which aspects of the material environment and experience … are transformed' (Pink, 2008a:164). These events seek to disseminate the practice of cargo-cycling, by demonstrating the utility of the practice, to engender systemic change in disaster preparedness, and to aid recruitment of practitioners to cargo-cycling as a means of transportation.

Here, through analysis of the 2012 DRT, I argue that insights from the scaling of practice theory, and scholarship on indirect activism, can usefully be combined to offer insights into the effectiveness of activities designed to challenge practice consensus, around the normalisation of driving.

## 7.2 Indirect activism – speaking for cycling?

In *The City and the Grassroots*, Manuel Castells (1983) argues that unequal access to collective consumption activities, such as shopping and leisure, creates frustration and targets for oppositional social movements, which seek to 'influence structural social change and transform … urban meanings' (p. 305). This categorisation delimits as social, only movements which combine improvements in collective consumption, community culture, and political self-determination. However, over time urban movements have changed, showing expansion, differentiation, and fragmentation, with Mayer (2006) identifying two trends. One focus sees movements subsumed into anti-globalisation mobilisations, while the other identifies a

subsuming under third-sector organisations, as stakeholders address issues such as social exclusion.

Cycling has been associated with a range of issues, including anti-globalisation, and attempts to overcome social exclusion, adding credence to the argument that cycling is never 'just cycling' (Aldred, 2012): it carries a host of meanings which are contested by cyclists and non-cyclists. Cycling's history further reveals connections to a number of parallel forms of advocacy and activism (Aldred, 2012), including women's emancipation and socialist agitation for improvements in the lives of the working poor (Horton, 2006). More recently, the pedal cycle has become the 'much-touted' vehicle of urban sustainability (Oldenziel & de la Bruhèze, 2012) and active travel. Approaching cycling from a practice theoretical perspective acknowledges that cycling occurs bundled with other activities and necessitates placing the practice of cycling at the centre of analysis, each performance of the practice being made up of the active linking of meanings, know-how, and material elements (Watson, 2012). The umbrella term cycling unites a number of identifiable sub-cultures, or practice-variants, across domains of utility, sport, and recreation. Cox (2007) for instance, distinguishes between four different types of cycling activity – transport, active pastime, play, and sport – each activity having some specific infrastructural, technological, and locational preferences and/or requirements. Such diversity leads Cox to explore the legitimacy of organisations lobbying for cycling, at national and international levels, asking who actually 'speaks for cycling' (p. 1).

Pink (2012) locates studies of activism, within a milieu of interdisciplinary studies, including geography and sociology focused on urban activism, noting the relevance of such approaches to activist practices and everyday life. Perhaps, because urban transportation issues frequently give rise to urban social movements (Batterbury, 2003), cycling activism and advocacy is often reviewed using social movement theory (Aldred, 2012). Shepard (2015) argues that the community organisation process within social movements, such as organising pedal cycle-based events, propels local community social change by 'challenging the regimes of the normal' (p. 2). In the literature, a distinction is sometimes drawn between the terms advocacy and activism. When a line is drawn, advocacy is seen as arguing in favour of something from within the system, whereas activism is more likely to be characterised as assertive action from outside the system, in support of, or opposition to a controversial issue. Further, direct activism may include overt acts of protest, which

frequently 'involve the physical body as a vehicle for protest', whereas indirect activism focuses on non-confrontational political acts 'that express critical concern' (Vélez, Perez Huber, Benavides Lopez, de la Luz, & Solórzano, 2008: 16). Indirect activism can be seen to share some attributes with advocacy, in the combining of individual and social actions designed to gain 'political commitment, social acceptance, and supportive policy and systems' (Richards, Murdoch, Reeder, & Rosenby, 2010: 1; World Health Organisation, 1995). It also shares social change targets with technology-, and product-oriented movements, generated out of alliances between businesses and civil society, focused upon support for alternative technologies, and the policies which promote them (Hess, 2005).

Whilst holding elements of advocacy and activism, Pink (2008a, 2008b, 2009) suggests recruitment to alternatives, via pragmatic rather than militant, confrontational strategies, to be a characteristic of indirect activism. Within cycling, these overlapping strands of activism and advocacy are discernible, with Batterbury drawing attention to this cross-over between advocacy and activism, where 'loose coalitions and small groups … move between opposition to local and city government and active collusion with it' (p. 153), as a common feature of campaigning. Showcasing alternative practice examples, and celebration of alternatives as a dissemination mechanism, is argued to be an important feature of contemporary indirect activism, a means of capturing the imagination, by using officially sanctioned 'legal' mechanisms (Leontidou, 2006). Perhaps as a consequence, contemporary indirect activists are often middle class (Pink, 2009). Chansky (2010) for instance argues indirect activism to be a demarcation of third-wave feminism which seeks to achieve social change through cultural action rather than through overtly political, electoral and legislative means. In the case of the Cittàslow (slow cities) movement, Pink (2008b: 97) argues that it is 'by disseminating Cittàslow as a model that Cittàslow the movement operates its indirect activism', of promoting 'alternatives' (Pink & Lewis, 2014: 696), which is in itself an alternative to the direct activism of local resistance and confrontational direct action campaigns. Thus, by this conceptualisation, Cittàslow is seen to 'persuade both by example and by providing alternatives to the … everyday experiences associated with global consumer capitalism' (Pink, 2008b: 98). Recently, Pink and Lewis have extended consideration of 'resilience as emergent – in the making … rethink[ing] how forms of indirect activism become 'active' in the world' (p. 696). This activation rests on local

knowledge, and location specific skills, to generate the alternatives practices of indirect activism (Pink, 2008b).

## 7.3 The three Es as a framework - elements, exemplars, and events

Indirect activism is argued to entail dissemination of a model through recruitment to a range of activities, through which the indirect activism is produced in the material environment (Pink, 2008a). This is an activism that, in the case of Cittàslow, provides 'local people with alternatives to what the movement's leaders see as the negative aspects of globalisation through, for instance, creating examples that demonstrate that there is another way to live' (Pink, 2008a: 174). The decarbonisation of transport is an example of a process which requires such demonstrations of alternative ways of living: a systemic change countering the dominance of automobility. Practice theory is argued to have the potential to yield new insights into how decarbonisation of transport can be encouraged (Birtchnell, 2012; Spurling & McMeekin, 2014; Watson, 2012, 2013). Practice theory has often been used to analyse domestic routines such as showering and food preparation, and as a consequence has been critiqued as a flat ontology (see, for example, Geels, 2011), not well placed to cope with the scaling of practices. Increasing focus on sustainability asserts a practice theory capable of analysing socio-technical transitions (Watson, 2012) and therefore, one which can manage the scaling of practices (Birtchnell, 2012). Indeed, Birtchnell (2012) claims that although routines are core to the performance of a practice, new 'suites' (Shove, 2003b) of material 'artefacts' (Reckwitz, 2002) can disturb and often help to reconfigure existing practices, in a way that allows system change to be brought about against a dominating practice consensus. Within such a practice consensus, nuanced performances of everyday life such as driving, are normalised when materials are combined with societal ideology. Fundamentally, Birtchnell argues that practices share elements, but that those elements are configured in different ways in alternative practices. For an alternative practice to gain momentum it must recruit carriers/practitioners. Birtchnell suggests that three mechanisms, the three Es, help to generate momentum, and hence scale, whereby pre-existing *elements* are reconfigured in alternative synchronisations by *exemplars* or *elites,* in demonstration *events*.

Birtchnell contends, that for a 'new normal' practice consensus to evolve, such as a travel practice consensus which does not rely on personal car use to transport

children to school, shop for groceries, and/or commute to work, then *elements* beyond the car itself need to be considered. *Elites* are seen to act as *exemplars* lobbying and exercising leadership by pulling together 'new practices from often disparate elements … [influencing] others through events where they attempt to establish a new consensus' (Birtchnell, 2012: 498). In this way, elites and the knowledge they bring of combining elements in alternative configurations, perform a role in allaying the fears people have about the adoption of a new practice (Jackson & Everts, 2010). One way that elites can act as exemplars, is by organising events which demonstrate and celebrate the utility of alternative practice configurations.

## 7.4 **Introducing the Disaster Relief Trials 2012 - context and method**

On 17 June 2012, the first Disaster Relief Trials took place in Portland, Oregon as an event within the annual *Pedalpalooza*, a three week-long festival of cycling. Characterised as "Real Roads, Real Loads", this was a cargo cycle trial designed to display cargo cycle capabilities set against a magnitude 9.1 earthquake event scenario on the Cascadia subduction zone, resulting in widespread Portland area destruction. The scenario was:

> It is day 4, your Neighborhood Emergency Team (NET)[18] just heard on the HAM radio that recovery supplies have been palleted and are ready for pick up, but obstacles exist. The transportation infrastructure is compromised and fuel is rationed or not accessible.

Riders had to traverse a 30 mile course with a payload of 100 pounds (approximately 45 kilos), including food aid in boxes and buckets, medical aid, a propane tank, fuel, tents and supplies (Figure 7-1). The payload was gradually amassed at checkpoints positioned throughout the course, which incorporated a number of obstacles consistent with post-earthquake devastation. These obstacles mainly required the riders to dismount, and sometimes unload their cargo cycles to negotiate them (transportland.org, 2011).

[18] The Neighborhood Emergency Teams (NETs) is a City of Portland run program where residents trained by the Portland Office of Emergency Management and Portland Fire & Rescue to provide emergency disaster assistance within their own neighborhoods. NET members receive basic training on how to save lives and property until the professionals can arrive (Planning for Resilience and Emergency Preparedness (PREP), n.d.).


**Figure 7-1 Disaster Relief Trials loaded bike**
(Source: transportland.org (2011))

Coming from Christchurch, New Zealand to research cargo cycle use in Portland, this event was relevant in several ways. It not only showcased the full range of cargo cycles in use in Portland, and allowed me to meet a number of cargo cycle enthusiasts, builders, retailers, and activists: it also linked cargo cycles to my experience of pedal cycle use in pre- and post-earthquake Christchurch, New Zealand. My experience in Christchurch, following the 22 February 2011 earthquake had been that pedal cycles were the most viable means of transportation through the destruction, faster than walking, able to carry loads, and capable of being negotiated over and through the devastation (Figure 7-2) and automobile gridlock.

**Figure 7-2 Fitzgerald Avenue, Christchurch immediately post the 22 February 2011 earthquake**
(Source: http://eqnz.blogspot.co.nz/2011/03/bunch-of-photos-1.html)

The organisers of the DRT used this event, to advocate for cycling and disaster resilience within the event scenario. What has been described as the chaotic reality of advocacy renders it a potentially uneasy fit with traditional methodological approaches (Richards et al., 2010). Pink (2012: 12) argues that 'to understand everyday life as both a source of activism and change … we need to comprehend it from within … through a theory of practice and place'. Conceptualising research within a practice theoretical framework has implications for the methodology employed, but at the same time, there is no pre-established defined methods repertoire (Harvey et al., 2012). This research comprises participant observation of the 2012 DRT, with semi-structured interviews with the three organisers of this DRT, conducted during preparation for the 2013 Portland DRT, privileging engagement over detachment and scaling to move from the micro to the macro, an approach consistent with the deployment of participant observation (Truninger, 2011). The analysis which follows is formulated in terms of Birtchnell's tripartite conceptualisation of the potential for the scaling of practices.

## 7.5 **DRT as elements**

According to Birtchnell, innovation is more likely to occur on the basis of the incorporation of pre-existing elements, or the mixing of new and pre-existing elements, in new ways, rather than relying entirely on new elements. Thus, new or 'new old' suites of materials, know-how, and ideas are often the cause of change, 'disrupting routines, and defying the inertia of stable practices' (2012: 498). Shove and Pantzar (2006) refer to forgotten, neglected, or unfashionable elements as 'fossils' which receive little attention in the innovation literature, which privileges the new over the old.

The cargo cycle is a new old thing, a fossil with a lineage which in Western countries dates to the late 1800s when cargo-capable tricycles were used by 'package delivery firms, butchers, newsvendors, and milkmen [sic]' (Petty, 2001: 118). The twentieth century saw pram-cycles and bicycle side-cars become a part of the domestic child-transportation realm (Basterfield, 2011). However, as one of the organisers of the DRT makes clear, in Portland cargo cycles in their current iteration are regarded as new:

> Portland people are weird … they really like being Portland people and maybe that's part of what it is … they've latched onto bikes in general and cargo bikes are a new thing and so there's a lot of excitement about what their

> uses can be. People I know in my age group, they've had a previous career and they're looking for a change, they're looking for some small business that they can use, and a cargo bike is a good way to make that business a reality without having to do a truck (PO8).
>
> Portland is the place … if you have any kind of practical bicycle transportation-expanding idea you'll find purchase in Portland … it's really true, and there are people who have designed their lives so they have time for these sorts of things (PO9).

Like Birtchnell's analysis of Gandhi's influence on systemic change towards self-sufficiency in local practices, in the period leading up to Indian independence which involved global and local practices, the cargo cycle is an element in utilitarian cycling and disaster relief practices, which has local and global significance. The inspiration for the DRT was based on local know-how of the efficacy of cargo cycles for load-carrying practices, awareness of the value of pedal cycles in post-disaster situations such as Kobe, Japan, and frustration with disaster response in the aftermath of the 2010 Haitian earthquake. In Japan, pedal cycles have twice been recognised as crucial in the aftermath of disasters. Following the 1995, 7.2 magnitude Kobe earthquake, residents and rescue personnel alike, 'turned to the bicycle for transportation', with according to *Bicycle News Japan*, food, bottled water, and bicycles and bicycle parts, being the three emergency necessities (Petty, 2001: 123). Later, following the devastating 2011 Tōhoku earthquake and tsunami:

> the bicycle has acquired a new reputation for reliability … Here all large technical systems came to a standstill, but cyclists discovered they could ride all over the disaster areas without having to depend on many infrastructures (Oldenziel & de la Bruhèze, 2012: 26).

Like Gandhi's focus on the lack of sustainability of taken-for-granted practices in pre-independence India, the DRT points to the impracticality of relying on taken-for-granted driving practices to meet need in a post-earthquake scenario in Portland. In designing a course which incorporated post-disaster 'broken roads', the organisers sought to 'prove the grace of the cargo bike, and prove the oafishness of a truck' (PO9) in such settings. The DRT imagines an alternative response based upon cargo cycle utility, which brings together, the materiality of the cargo cycles, riders, supplies, and road conditions, and links those material elements to images of self-sufficiency, local resilience and community building. Know-how is accounted for, both in terms of the use of cargo cycles, but also in the organisational know-how of event pre-planning, and the additional combining of practices, such as co-ordination via HAM radio operation.

## 7.6 **DRT as exemplar**

Birtchnell uses the terms exemplars and/or elites, to refer to those practices championed in alternative synchronisations of elements by elites, which hence receive underpinning authenticity, and reveal the feasibility of the physical performance of alternatives to normalised conventions. Here, in privileging the term exemplar, I place particular stress on the leadership by knowledge and example, of early adopters who demonstrate alternative practices as 'self-led socio-technical transitions from the bottom-up' (Birtchnell, 2012: 500). The DRT can be seen as an example of 'exemplary practitioners' championing a practice as a showcase, to help facilitate the recruitment of practitioners and defection from pre-existing dominant practices, such as driving. The DRT is used to advocate for cargo-cycling as a 'lifestyle politics' (Lewis, 2014), which involves negotiating a tension between transforming daily living and embedding new practices within systemic norms, habits, and routines (Lewis, 2014).

According to Birtchnell (2012: 498), elites have 'long sought to engage people through championing … practices around specific material elements', such as developing popular events; a practice as collective action' (Barnes, 2001). The organisation of the DRT involved three key players, who each brought important know-how to the event organisation. PO9 had the original idea for the event, as a personal response to the Haitian earthquake. Bringing cargo-cycling knowledge and connections based upon a history of working as a cycle courier and mechanic, and in cycle advocacy, he saw his role primarily in terms of gathering sponsorship, by 'explaining the story to those who would be interested anyway'. PO8, as the person behind the TransPortland website – a clearinghouse of cargo-cycling ideas - played a significant role in connecting people, most importantly for the DRT, connecting PO9 with PO7. PO7, another cargo cycle enthusiast brought a background in community resilience, disaster preparedness connections, and professional knowledge of branding and marketing. According to PO9, PO7 is a 'stickler for authenticity', which coupled with connections to organisations such as the Oregon Air National Guard, gave the DRT access to military property as a route checkpoint, adding 'delicious authenticity' (PO9) to the event.

As exemplary practitioners of cargo-cycling, the three organisers of the DRT demonstrate what Birtchnell calls an alternative practice-consensus, demonstrating a practice suite that they hope can infiltrate the social imaginary (Taylor, 2002) of a

broader societal base, whereby a 'common understanding … makes possible common practices and a widely shared sense of legitimacy' (p. 106). One way that cargo-cycling for disaster response was legitimised in the wider context of the DRT was in the creation of, 'in the universal language of modern society' (PO9), a recognisable brand. This was partly achieved by the release of a photograph in the lead up to the event, showing two cargo-cyclists with fully equipped disaster response cargo bikes operating as members of a Neighborhood Emergency Team (Figure 7-3). According to PO9, this photograph was invaluable in generating a social media presence, a 'hugely powerful visual statement … headlines and photographs are so important', operating as an immediately recognisable exemplar of sanctioned cargo cycle capability. Thus, the DRT organisers not only led by example but also circulated further visual image exemplars of the world they envision.

**Figure 7-3 NET team**
(source: participant)

## 7.7 DRT as event

The third E - event - is an opportunity for exemplary practitioners to draw others to specific events to protest, demonstrate, and advocate change. Thus, events are a means of championing alternatives to existing practice consensus, in a way which shows how alternatives can be synchronised and embedded within everyday life (Birtchnell, 2012). In this case, the DRT not only showcases cargo-cycling as an

ordinary mode of load-carrying but also how utility can be maintained in disaster situations, where the utility of normalised modes of load-carrying is compromised. Thus, as a celebratory event (Pink, 2008a), the DRT highlights the capabilities of the cargo cycle, with the aim of transforming how people imagine load-carrying and disaster resilience.

Like Pink's analysis of Cittàslow, DRT is a form of activism 'which works by providing local people with alternatives to what the movement's leaders see as the negative aspects of globalisation through, for instance, creating examples that demonstrate that there is another way to live' (Pink, 2008a: 174). In the DRT the emphasis is on daily utility, which builds-in disaster response based upon intrinsic preparedness, because as PO9 points out:

> one of the profound problems with the traditional preparedness activities like having a box with X number of days- worth of crap in the garage … those things are important but they do not pay any dividends if you never use them and that constitutes this huge collective drain on our time, energy and resources, and that having a garden, riding a bike and canning vegetables and all those things, do not do those things. If we never have a Cascadia subduction zone earthquake in our lifetimes, it really doesn't matter if we are doing all those other things.

For the DRT organisers, phase two of the 'advocacy mission' is the proliferation of the DRT event to other interested towns and cities. As well as the Portland DRT running at a larger scale in 2013, 2014 and 2015 in association with other events to widen its appeal and to operate from a more central city location, DRTs have also been run in the US in San Francisco, CA; Seattle, WA; Boulder, CO, Eugene, OR; and in Canada in Victoria, BC, with more scheduled for 2016. This has partly been achieved by distributing a digital 'de facto cookbook … to inspire organisers [to] legitimise this thing in the fastest way possible … purely to make it happen' (PO9). A second facet of this process has been achieved by PO7 providing sketch-ups of the original DRT shield logo, redesigned to incorporate an element of each event and city that has hosted a DRT (Figure 7-4). Representing part of the cookbook approach to dissemination, the branded but individually distinctive shields, present an image of the DRT as 'somewhat of a series … a franchise' (PO9) focussed on community dissemination rather than profit.


**Figure 7-4 DRT shield variations**
(source: http://disasterrelieftrials.com and author)

## 7.8 **Discussion – DRT as scale and indirect activism**

According to Shove et al. (2012), practices consist of three basic elements, materials or stuff, images (symbols and meanings), and skill (competence, know-how, and technique). A practice-as-entity can be regarded as the sum total of the performances of a practice within timespace, and as an ideal-type template to be filled out by individual performances (Reckwitz, 2002). Within each performance, the three types off elements are linked together by practitioners, who form the unique crossing point of practices (Reckwitz, 2002). Consequently, practices exist, persist or disappear in relation to the creation, sustenance, and breaking of those links (Truninger, 2011). Thus, the practice of cargo-cycling requires for instance access to a cargo cycle (the material object), developing the skill and know-how to use it, and identifying with a new normal practice consensus of load-carrying by pedal cycle, rather than by motor vehicles. Importantly, in practice theory the practice meanings derive from and 'belong to' the practice, rather than emerging from the practitioners (Røpke, 2009: 2492). Cargo cycles, as identified by PO8, are regarded in Portland as what Vivanco (2013b: xx) calls "the new thing" re-envisioned as a 'transformative vehicle at the cutting edge of urban change', but which, given their roots as delivery pedal cycles in the late 19th and early 20th century, are actually a 'new *old* thing'. This idea of new old things accords with Shove and Pantzar's (2006) conceptualisation of fossilisation, where they suggest that the know-how and meanings of practice may disappear leaving behind the material remains which may later be resurrected in association with new meanings and contemporary know-how. Such bringing together in the reproduction of cargo-cycling, extends the normalised meanings of cargo-cycling, in its bundling with the practices associated with disaster resilience, as well as day-to-day load-carrying practices. As Vivanco points out:

> there are important contours to how and why bicycles have become desirable and useful in different places and a different times, contours that are closely tied to complex and dynamic interplays of technological innovation, industrial capitalism, consumerism, advocacy movements, urban change, and national and cultural particularities (p. xx).

Those practice contours see the elements of cargo-cycling brought together at the intersection of a range of practices, the organisers of the DRT seeing an opportunity to demonstrate and celebrate the extension of that range of practices, that can cluster around and be accomplished by cargo cycling, thereby entrenching it as both a mode of transport, and a component in resilience-preparedness practices.

This celebration of alternatives which Pink (2008a) highlights as a cornerstone of indirect activism, has been an obvious component of contemporary forms of 'velorutionary' counter-cultural (Rosen, 2002b) pedal cycle activism. In what Furness (2010) calls biketivism, "critical mass" events have sought to reclaim the streets for cycling, by bicycling in groups, which may number hundreds or thousands of participants (Aldred, 2012). Critical mass is essentially a celebration of cycling and a form of direct action, which may or may not be sanctioned by authorities, and which spreads via local organisation rather than through central leadership (Furness, 2010). This bridge between the sanctioned and non-sanctioned allows different manifestations of critical mass to straddle conceptions of advocacy and activism, as a celebratory activity which may become confrontational.

Another form of contemporary biketivism which I argue can be conceptualised as indirect activism, is seen in the *ciclovía* open streets events where streets are closed to cars to encourage walking and cycling. Lugo (2013) argues that such events increase the visibility of cycling in cities such as Los Angeles, by supporting the 'human infrastructure … built on existing networks of cyclists' in such a way as to 'challenge divides between human and non-human actors' (p. 202). *Ciclovía* can be thought of as a form of indirect activism, based around collaboration with city officials to open up temporary 'experimental spaces for bicycling' (p. 202). Other forms of indirect biketivism, which do not require official sanction, include informal buddied rides and group commutes (Aldred, 2012) where experienced cyclists support would-be cycle commuters to learn urban cycling techniques and way-finding in real-time, by commuting together.

As celebratory events, bringing together multiple elements of cycling practices, events such as critical mass, *ciclovía,* and the DRT seek to disrupt practice consensus around driving, which normalises mobility based around private motorised vehicles. In seeking to disrupt and transform the normalisation of load-carrying based upon cars and trucks, the DRT organisers have recognised the importance of the role of demonstration as a cultural intermediary (Bourdieu, 1984; Truninger, 2011), whereby middle-class professionals, and those committed to alternative lifestyles, as identified by PO8, build into their lives the promotion of new styles of consumption. Operating as exemplars of a practice is argued to increase the pool of competence and confidence in the handling of a technology or artefact, in this case, the cargo

cycle, and to thereby increase the capacity of a practice to be enacted successfully (Shove et al., 2007; Truninger, 2011).

The organisers of the DRT recognise the value of extending the image of cargo-cycling at multiple levels across a diversity of platforms. PO9's background in branding led to the creation of images (Figure 7-4) as a powerful visual statement of the basic capability of cargo cycles, which in its association with the officially sanctioned NET teams, adds another layer of authenticity and normalisation to cargo-cycling as a multi-purpose carrier of practices. Tacit associations with city and state governance further serve to legitimise cargo-cycling as a versatile and resilient transport mode. Thus, the three organisers in their civic participation, seek to shape an alternative geography of their city, by engaging in indirect activism (Dork & Monteyne, 2011; Pink, 2008a). This engagement is extended by making use of digital technologies such as the circulation of the photographs (Figure 7-3), which both extends their impact and facilitates connections with other like-minded activists and related causes (Dork & Monteyne, 2011). This form of dissemination, seen in the use of social networking sites and blogs to organise and advertise such events, and increase consultation and participation, is argued to be 'booming' (Aldred, 2012: 95).

As an event, the original Portland DRT was partly conceived in response to disaster events such as the Haitian and Japanese earthquakes. Petty (2001) reports that in the aftermath of the 1995, 7.2 magnitude Kobe earthquake the emergency necessities were food, water, and bicycles. Two thousand new bicycles were donated by the bicycle industry, and used bikes were supplied by relief organisations. Recognition of the utility of pedal cycles in general, and in particular the cargo capabilities of cargo cycles was a major driver behind the rationale for organising the DRT. In common with other forms of direct and indirect activism, the DRT is a temporary and experimental window on alternative forms of organisation and interaction, which has been repeated in Portland and copied in other cities. Like the Cittàslow movement of Pink's analysis, the DRT ultimately seeks to improve local liveability and community resilience (Dork & Monteyne, 2011), both in terms of preparedness for disaster, and by promoting the adoption of a practice, which has been identified by the organisers and participants, as an efficient, community, and environmentally enhancing means of daily mobility.

Prior to the event, the DRT organisers had gained support from the Director of the Portland Bureau of Emergency Management (PBEM), who is reported as stating:

> We see cargo bikes, as well as motorcycles and scooters, playing critical roles in the event our transportation system is compromised from a large scale earthquake. Whereas widespread damage or debris may make roads impassable for cars or emergency vehicles — bikes and motorcycles may still get around. We hope to tap into this network for assistance delivering food, fuel, tools, water, medical supplies, other emergency supplies (http://bikeportland.org/2012/03/28/the-next-frontier-for-cargo-bikes-disaster-response-69571).

While this focus on influencing government preparedness plans does not explicitly fit with Mayer's (2006) categorisation of contemporary social movements, it does concur with Pink's identification of a need to analyse 'how urban social movements might be connected to, influenced by, and indeed *influential in* state and government bodies' (Pink, 2009: 453). Nine months after the first DRT, PO9 reports that it was extremely successful with 'moving the needle with emergency planners around Portland', in moving their focus away from scooters. According to PO9:

> There is now a tangible change in interest at county Portland Bureau of Emergency Management … DRT is certainly part of that, partly due to constant harassment and news reports on lack of preparedness … Tokyo running out of bikes was noticed in Portland, especially given [the higher] level of preparedness in Japan relative to Portland'

Increased engagement the City of Portland's authorities has had tangible benefits. One such benefit saw the City putting forward a project based upon cargo bikes, as their centrepiece funding proposal to a creating resilience initiative of the Federal Emergency Management Agency (FEMA). The proposal was based around two custom designed cargo cycles, one for medical response and the other a power generation hub/HAM radio unit, both primarily intended as demonstration units to promote public awareness of disaster preparedness. Here, the DRT organisers have extended their influence with government bodies, based upon the success of the first DRT and their ability to pin-point leverage points within the system, which can be exploited in the scaling-up of cargo cycle integration into emergency management practices.

Dissemination through recruitment (Pink, 2008a: 164 ) was another aim of the 2012 DRT. The organisers admit that this was a less successful element of the 2012 event, as it attracted those already recruited to cargo-cycling, and not the 'cargo curious' (PO7). The planning for the 2013 and subsequently the 2014 and 2015 events in Portland, incorporated the DRT within larger well-advertised events, that present opportunities for more cargo cycle exposure to families. Incorporation within larger

multi-interest events seeks to increase the dimensions of such moments of practice recruitment, in order to convey a normative framework of achievement (Truninger, 2011) of load-carrying tasks by cargo cycle. Taylor (2002: 111) refers to what he calls the:

> long march … a process whereby new practices, or modifications of old ones, either developed through improvisation among certain groups … or were launched by elites in such a way as to recruit a larger base. Or alternatively, a set of practices in the course of their slow development … gradually acquired a new meaning for people and hence helped to constitute a new social imaginary.

The DRT I argue is endeavouring to increase the pace of the long march of supplanting driving as the normalised practice of load-carrying, by demonstrating and recruiting to, a suite of practices based upon cargo-capable cycling. In this gradual development of associations to meanings of cargo capability, the organisers have made the most of their connections across a range of domains, including the pedal cycle industry and government institutions, to increase the effectiveness of the indirect biketivism. In exploiting those connections, and by producing a "cookbook" to disseminate the knowledge they have gained in running the inaugural Portland event in 2012, the long march has been able to bifurcate into other cities. This cookbook approach facilitates the travel of the elements of the practice of DRT, in a sharing process (Birtchnell, 2012) facilitating their recombining in location specific exemplars of DRTs, a process of 'impressing upon others their importance and efficacy' (Birtchnell, 2012: 498) and underpinning the authenticity of DRTs as a mechanism to show the feasibility of the performance of alternative modes.

## 7.9 **Concluding comments**

Looking at the DRT in terms of Birtchnell's tripartite conceptualisation of elements, exemplars, and events is a mechanism for reflecting upon the advancement of the destabilisation of practice consensus around driving, and advancement of alternative cargo cycle based load-carrying practices. Focusing on load-carrying utility and disaster preparedness, I locate the DRT as a form of indirect activism or biketivism, which seeks to encourage and direct change, by drawing others to specific events which demonstrate and advocate change, by the use of cargo cycles for load-carrying practices. Employing techniques which exemplify indirect, non-confrontational forms of indirect activism – celebration, alternative practice demonstration, recruitment via dissemination and transformation, and legalised, sanctioned activities – the DRT seeks to embed the cargo cycle in localised structures of disaster preparedness and disseminate, to cargo curious citizens. By reflecting on my

observations of the first DRT held in Portland in 2012 and by gathering the subsequent reflections of the organisers of the first DRT, I have situated both the aims and practice techniques of the DRT within its local environment. By 2015 DRT had grown into an annual event in Portland, and a regular event in several other cities in the United States. I have not sought to evaluate whether this persistence and growth represents "success", instead reflecting upon how these early-adopters of cargo-cycling, as exemplars of the practice, sit at both the intersection of practices that can be accomplished with cargo cycles, but also at the intersection of the 3 Es in disseminating a would-be alternative practice consensus. Thus, I respond to Birtchnell's call for more detail about how 'certain types of elites take on practice in action as well as rhetoric' (2012: 501). In so doing, I have illuminated some of the processes by which the DRT has been championed by exemplary practitioners, who seek to extend the appeal and utility of cargo-cycling and thereby challenge existing practice consensus.

Like Pink's studies of Cittàslow, the DRT is a form of legalised urban indirect activism, which within the context of what PO8 characterises as the excitement in Portland about the uses cargo cycles can be put to, has the potential to engender broad activist appeal. The DRT is represented as an answer to a local problem: disaster resilience following a significant Cascadia earthquake event. However, the scenario scales from lessons learned from recent international disaster events, and the scenario recipe, like all good recipes, can travel and be adapted to local ingredients, infrastructures, and cultures.

By their own admission, the organisers of the first DRT recognise that they were most successful at engaging with governance structures, the cargo cycle industry, and practitioners already embedded within cargo-cycling practices. Engaging with and extending the ranks of the cargo-curious was quickly identified as a necessary strategy for future events. From a practice theoretical perspective, for a practice to grow, recruitment rates must be maintained at a higher level than defection. In trying to promote an alternative practice consensus around disaster preparedness, the DRT is seeking to engender proactive recruitment prior to a disaster event. This then is a distinctive form of persuasion, through example and celebration, which combines fun and celebration within the public domain, with routine daily practices of load-carrying for domestic and commercial logistical purposes, informed and influenced by global events. Such a showcase is based upon embedding and inter-

locking suites of practices in the present, which not only increase daily well-being and sustainability, but also long-term resilience in a manner which in the words of one participant, presents a 'magical' opportunity for 'glorious lives filled with exercise and fresh air and human scale connectivity'.

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## 7.10 **Practice summary**

The visual representation of the practice dynamics zoomed in upon in Chapter 7 (Figure 7-5) reflects the intended impact of the DRT as a cross-cutting form of indirect activism, which showcases how the introduction of an alternative practice element – the cargo bike – to specifically the carriage of goods and equipment.

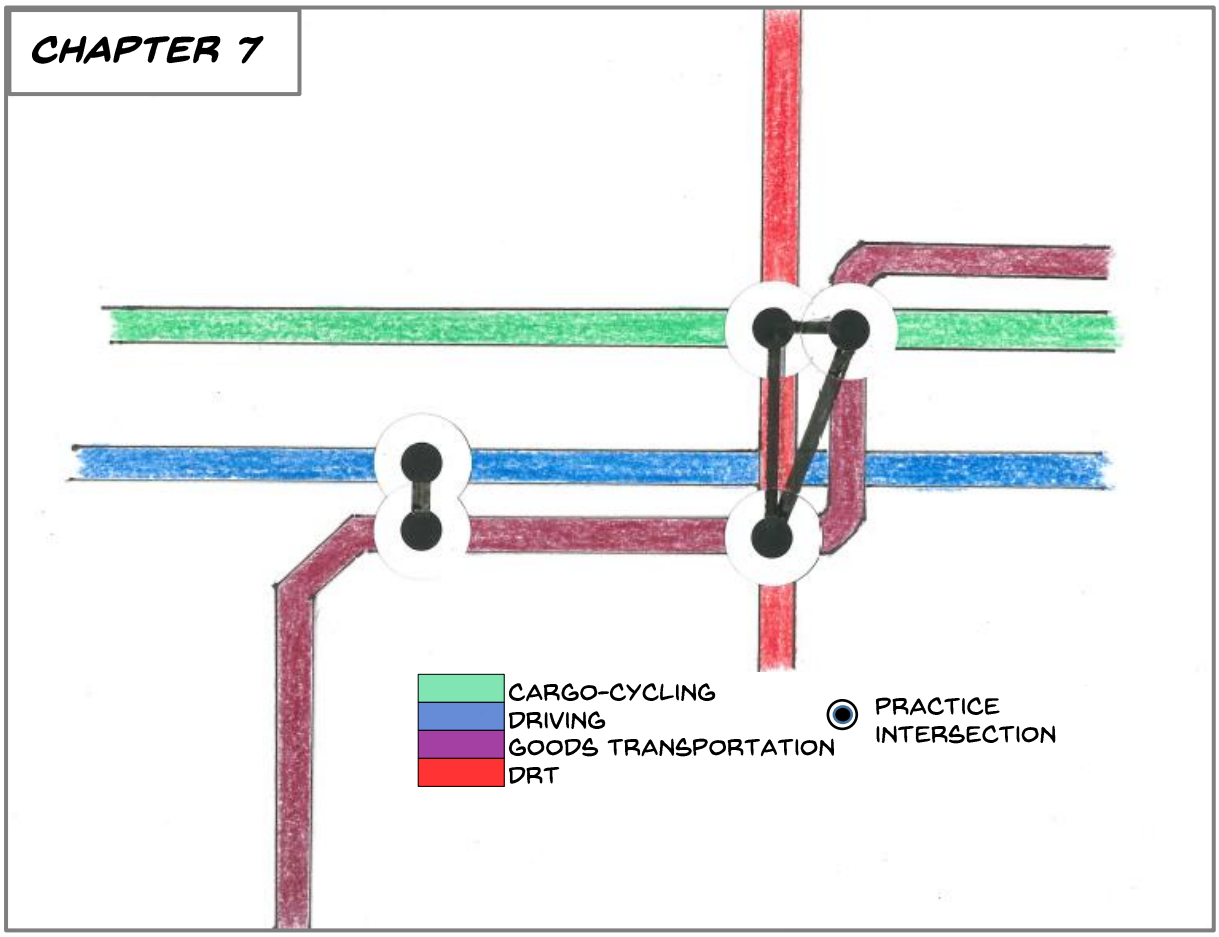


**Figure 7-5 Chapter 7 practice summary**

The organisers, in presenting an exemplar of the versatility of cargo bikes in a disaster scenario introduce and showcase alternative competences and images of cargo–cycling to prompt a congealing of load-carrying practices around cargo-cycling

rather than driving. In so doing, images and competences of the practicality and affordances driving for load-carrying are dislodged. A disaster response scenario is shown to challenge the very infrastructure which driving, in the system of automobility relies upon, with cargo cycling presenting a more autonomous form of mobility.

Chapter 8 now turns to another aspect of cargo-cycling, by zooming in on the inclusiionary potential of cargo-cycling, to overcome the transport disadvanntage of car dependence, in negotiating need for mobility.

# Chapter 8 'It's more a replacement for a car than a bike': negotiating mobility need – the relationship between cargo-cycling and driving

## 8.1 Introduction - What is the problem represented to be?

In an April 2015 edition of a prominent New Zealand daily newspaper published in Christchurch, the main front page story appeared under the headline *Cycleway plan panned by study: economists question business case for spending* (Cairns, 2015). The cycleways in question, are those planned as part of the rebuild of the city following the devastating effects of the 2011 Christchurch earthquakes. The first paragraph of this article, reports the economists as saying 'the city council could buy new cars for every convert to cycling for the same amount of money' (Cairns, 2015: A1) as the proposed spend of NZ$156 million by the Christchurch City Council. This language is interesting in a number of respects; here I focus on the normalisation of driving implicit in this reporting, based upon taken for granted assumption that people only want to drive and that driving is the only mechanism by which mobility needs can be met. This normalised position is difficult to reconcile with the decarbonisation of energy consumption necessary in the transport sector to mitigate climate change (Marsden, Mullen, Bache, Bartle, & Flinders, 2014). Given that energy is used to accomplish social practices, demand for energy for mobility purposes is clearly related to what people do. This study focuses on what participants do in two cities - Christchurch, New Zealand and Portland in the US state of Oregon - to achieve the multi-functional load-carrying mobility normally associated, in many Western countries with driving. For these participants, the day-to-day trip-chaining associated with among other activities, shopping, transporting children, and commuting is achieved using a cargo bike. Cargo bikes are built in various configurations, the main difference from other utilitarian pedal cycle designs being extended length and increased strength to accommodate a load carrying platform either to the front or the rear of the rider (Figure 8-1) - hence the terms front-loader and longtail.

**Figure 8-1 Longtail (left) and home-built front-loader (right) cargo bikes in Christchurch**

To examine this negotiation of normalisation, I make use of practice theory. Practice theory can facilitate the interrogation of the enrolment of people into the nuanced performance of practices which have become normalised in their society, such as the bundling together of encumbered activities - shopping, commuting and transporting children - with the practice of driving. Birtchnell (2012: 497) argues that such practice-consensus 'occurs regardless of potentially negative impacts' on the performance of other alternative practices. In analysing how cargo bikes have been incorporated into mobility practices, I incorporate insights from practice theory with scholarship on car dependence and transport disadvantage. The car dependence literature on which I focus reflects an extension of analysis of transport disadvantage to incorporate issues of car-related economic stress and time poverty, experienced by those living on low and moderate incomes. Here, I further extend consideration of the economic aspects of "forcing", to issues of normalisation of societal expectation, as expressed in conventions of what it is to do load-carrying, particularly when that load-carrying involves the transportation of children, and how that normalisation conditions possibility.

The five subsequent sections in this article develop this argument, starting with a necessarily brief outline of the theoretical underpinnings of practice theory, and debate concerning car dependence, before reviewing how scholarship has recently conceptualised the relationship between car dependence and transport disadvantage. The empirical analysis of cargo-cycling practices in the two case study

cities is then contextualised. The methods employed are briefly outlined before drawing-out key themes from the interview data pertaining to the relationship between cargo-cycling and driving. In the final sections, I reflect upon how the participants in this study negotiate a relationship between the practices of cycling and driving by incorporating cargo bikes into their cycling practice. I argue that for these participants, cargo-cycling extends their ability to negotiate cycling with driving practices. However, the anti-exclusionary potential of cargo-cycling in enhancing well-being and reducing the economic stress and time poverty associated with driving can only be realised if capital cost constraints can also be negotiated.

## 8.2 Insights from practice theory

Shove (2004) suggests, that routine and normally accepted standards of practice are infrequently articulated, let alone critiqued in any domain, their afforded value rarely questioned. One way of looking at car dependence is to view it as a characteristic of practices: as a consequence of peoples reliance on driving to conduct daily load- and people-carrying, and commuting practices (Shove, Watson, & Spurling, 2015). Taking this route to analysis suggests that in many instances, driving results from derived demand, occurring as part of the bundling of practices, such as child transportation and shopping.

Thinking about issues from a practice theoretical perspective is a sensitising process, which allows for some turning-around of taken-for-granted problem framings, assumed to be self-evident (Bacchi, 2009). Practice theory places practices at the centre of analysis, focusing on doing rather than thinking, and decentring individuals who instead become the unique crossing points of practices (Reckwitz, 2002), actively combining the elements that together make a practice performance (Shove et al., 2012). More recent developments by Shove and colleagues put forward a deliberately analytically simplified version of practice theory known as social practice theory (SPT) which seeks to inspire analytical investigation (Røpke, 2009). Accordingly, SPT conceptualises a practice as the configuring of three broad categories of heterogeneous elements - material (objects, equipment, infrastructure, and bodies), meaning (sense-making cultural conventions and expectations, emotion, belief, and understanding), and competence (explicit, experiential, and codified skills, and tacit know-how) - which are all regarded as being emergent properties of the performance of the practice rather than being held within the individual practitioner (Maller, 2015; Røpke, 2009). SPT stands out from other

theories of practice in four main ways, by highlighting the importance of materiality – the constitutive role of non-human technologies and things in framing everyday life, the dynamic nature of practices as represented in performance variation, the rhythmic bundling of practices in space and time, and the importance of recruitment, reproduction and defection to the persistence of practices entities (Shove et al., 2012). The practice entity can be understood in two ways: as an ideal-type template or block to be filled out by individual performances (Reckwitz, 2002) which enables judgements to be made about the sameness or difference of performances, or as the sum total of all recognisable performances of that entity in timespace (Schatzki, 2009).

SPT directs focus to what human/non-human hybrids 'are actually *doing* … [as] effective configurations' (Shove et al., 2012: 10-11, emphasis in original) - the primary focus of study. Approaching practices as effective configurations, necessitates a move beyond performances as integrative moments, to how multiple performance-variants exist as dynamic, recursive expressions of a practice entity. The coming together of performances of multiple and variable practice entities in time and space, and the effects of that co-location, are seen as crucial for trajectories of practitioner recruitment, reproduction, and defection. Pantzar and Shove (2010a) envisage several possible relationships of co-habitation within a bundled network of practices. Practices may be co-located in time and/or space but have no direct relationship. When practices, through for instance the temporal sequencing of rhythm and synchronicity, come into closer collaborative, cohabitative relationships they can form complex intersections of practices which become hard to unravel. Taking the analogy further the practice strands at the intersection can become so co-dependent, that they effectively fuse together, forming a new meta-practice. Equally, the intersection can suffer attrition from competitor practices, so that it degrades and breaks down, potentially allowing new intersections to form.

Acknowledged as effective in analysing small scale routines, local specificity, regularity, and repetition of domestic practices, practice theorist have also addressed the conceptualisation of sustainable consumption (Walker, 2013; Warde, 2014) and the decarbonisation of systems of mobility (Watson, 2012). However, Walker (2013) points to practice theories' lack of attention to practice lock-in, and the technological and social 'winners and losers' (p. 83) which will eventuate from moves towards more sustainable decarbonised mobility. Here, in bringing together insights from SPT and

the car dependence literature, I investigate the negotiation of practice lock-in by cargo-cyclist/drivers in Christchurch and Portland.

## 8.3 Car dependence - winners and losers

According to Urry's (2004) conceptualisation of the system of automobility, car ownership and use become taken-for-granted as core needs of 'normal' functioning, a path dependent process which is highly resistant to change. Mode imbalance tipped towards cars limits modal choice (Glover & Low, 2008), particularly for those without access to driving as a practice. Soron (2009) argues that car dependence derives from locked-in 'compulsory consumption', whereby driving is understood as 'a practical imperative in locations where the car has edged out alternative forms of transportation as viable options for meeting people's varied and interconnected transportation and survival needs' (p. 188). This car dependence, on the basis of lack of alternatives, means that employment, shopping, and other core activities can become contingent on access to a car. Lack of alternatives reinforces driving in car-dependent cities, absorbing 'public and private capital, urban space and other resources' (Glover & Low, 2008: 26). Thus, the system of automobility and its attendant inequity is further perpetuated, as sunk investments in privatised modes of transport become used as a 'rationale by households and governments to continue to use and invest in private cars and the associated infrastructure' (p. 26), facilitating dispersed land-use which in turn promotes greater reliance on cars (Mattioli, 2014).

## 8.4 The transport disadvantage of car dependence

The price of oil impacts household spending on transportation (Aftabuzzaman & Mazloumi, 2011). High oil prices have a greater and regressive impact on vehicle owning households, the effect being greatest for low-income households with limited transport choices (Litman, 2011). Car dependence is closely associated with transport disadvantage, defined as difficulties in accessing public and private transport and/or the problems associated with needing to own and maintain more private transport than a household can reasonably afford (Rosier & McDonald, 2011). Within the literature a number of strands are discernible, locating transport disadvantage as a multi-dimensional problem (Gleeson & Randolph, 2002), broadly sub-divisible into consideration of problems associated with living without a car (car deprivation), those of living with a car conceptualised as car-related economic stress (Mattioli, 2014) or forced car ownership (FCO) (Currie & Senbergs, 2007), and wider

issues of time poverty. Here, I restrict my focus to issues associated with car ownership.

### 8.4.1 Car-related economic stress and forced car ownership

A number of authors have considered the transport disadvantage of car-related economic stress (see for example Gleeson & Randolph, 2002; Mattioli, 2014) - the difficulty associated with *maintaining* the cost of private transport, including costs of, for instance, fuel purchase, insurance and maintenance (Rosier & McDonald, 2011). Studies focussing on the suburban fringes of Australian cities, note that this phenomenon confers disadvantage across a broad segment of the population (Currie & Delbosc, 2009). The combined financial burden of transportation and housing are seen to lead to trade-offs, with lower-cost housing at the urban periphery increasing transportation costs, impacting those on moderate as well as low incomes (Hickey et al., 2012). Given that viable public transport can be difficult to access at the urban fringe, the transport system is argued to induce transport stress (Currie & Senbergs, 2007), and mediate social opportunity and disadvantage, by interacting with the housing market to force car use (Atkinson, Dalton, Norman, & Wood, 2007). In Paris, Motte-Baumvol, Massot, and Byrd (2010) characterise the urban fringes as 'clubs' (p. 616) which exclude those who cannot pay the membership fee of automobile ownership and use.

This idea of location forcing car use is not new. Jones (1987) originally suggested that low levels of public transport provision may 'force' car ownership onto poorer households, necessitating sacrifices to meet car ownership costs, and generating 'an *inverse* relationship between car-ownership and social well-being' (p. 36). Banister (1994), when considering the social cost and equitability of the transport system, drew attention to whether car ownership is voluntary, and thereby not necessary to access facilities, or required and therefore not able to be foregone.

The forced car ownership (FCO) concept has been applied to several Australian cities (Currie & Senbergs, 2007; Miller, 2009), examining the inter-relationships between income, location, accessibility, car ownership, and public transport supply, and drawing attention to observed tensions between framings of car deprivation and car-related economic stress. FCO is found in one study to not be limited to the urban fringe, occurring 'irrespective of public transport supply, residential location, or socio-economic level' (Miller, 2009: 76) suggesting additional factors such as trip-

chaining, destination, travel time, and hours of public transport operation may be contributory.

Wary of the term "forced", given households apparent willingness to acquire automobiles even though their costs may cause car-related economic stress, Currie and Delbosc (2009) contrast low income households with high car ownership (LIHCO) with low income, no car (LINCO) households, arguing that the relationship between income, car ownership, and disadvantage may have been oversimplified, with transport disadvantage probably more related to means rather than lack of transport (Currie & Senbergs, 2007). In certain situations, such as when people have access to activities via alternative modes, and therefore do not have to spend a high proportion of their income running a car, Currie and Senbergs find not owning a car can be financially advantageous. Further, they suggest that owning a car on a low income, particularly in outer suburbs, may be a better indicator of disadvantage than advantage.

### 8.4.2 Time poverty and well-being

Time is a frequently overlooked aspect of transport policy-making (Dudley, 2012), despite time pressure being 'an almost universal [city] experience' (Tranter, 2011: 9), which can be a source of transport disadvantage to those on moderate as well as low incomes (Currie et al., 2010). Time poverty is strongly associated with childcare responsibilities and being in employment, and can generate feelings of isolation and reduced well-being (Currie & Delbosc, 2010). In their study of LIHCO and LINCO households, Currie and Delbosc find no differences in well-being using standard measurement techniques. However, in modelling the links between transport disadvantage, social exclusion, and well-being they find transport disadvantage decreases well-being, mediated by time poverty where transport disadvantage increases time poverty, and time poverty decreases well-being.

To summarise, analysis of transport disadvantage shows it to be a complex issue, that across its manifestations affects the well-being of a broad socio-demographic, not only centred on the car deprived, but also on those who experience the financial and time poverty stresses of situations which appear to force compulsory car consumption. In the next section, I expand consideration of car dependence by introducing cargo-cycling (as a practice-variant of cycling), as a mechanism for

achieving complex, load-carrying mobility needs, as an alternative to, or in combination with driving.

## 8.5 Practicing cargo-cycling – context and method

Car-dependent cities are oil dependent, and in American, Australian, and New Zealand cities private cars are used for most trips (Aftabuzzaman & Mazloumi, 2011; Dodson & Sipe, 2007). Internationally, some world cities which have historically embodied high car-use characteristics have successfully promoted cycling, using means similar to those used to great effect in cities like Copenhagen, Amsterdam, Groningen, and Muenster (Buehler & Pucher, 2012).

Globally, New Zealand has one of the highest rates of vehicle ownership (Rose, Whitten, & McCreanor, 2009). Predict and provide transport policies have dominated policy formulation (Lyons & Goodwin, 2014), and current government policy remains focussed on building 'Roads of National Significance' (Ministry of Transport, 2014). Although per capita car use has recently declined in New Zealand's two largest cities, it is either flat or growing in the remainder of the country (Lyons & Goodwin, 2014). Per capita car ownership is highest (0.83 in 2013) in the province of Canterbury, where New Zealand's third largest city - Christchurch - is located (Ministry of Transport, 2015b). In Christchurch seven percent of travel to work journeys at Census 2013 were by pedal cycle, only exceeded by the significantly smaller city of Nelson (Statistics New Zealand, 2015). Based upon my own estimates I would suggest the fledgling ownership of cargo bikes in the Christchurch would amount to less than 100 units. Research in Christchurch has to be understood in the context of the major infrastructural devastation which took place during the series of earthquake events which began on 22 February 2011. At the time of writing in 2016, infrastructural repairs are ongoing, with consequent disruption to the roading and cycling network. By October 2016, 1,384,236 $m^2$ of road had been replaced or repaired amounting to 95 percent of the required repairs (http://strongerchristchurch.govt.nz/more-progress). The damage and ongoing repairs, have implications for among other issues congestion, road space, safety, travel time, and wear and tear for all modes and their relative viability. The post-earthquake housing shortage also put intense pressure on house prices and rents, with house prices increasing by 30 percent in the five years since 2011 (http://www.stuff.co.nz/the-press/business/yourproperty/71647522/Christchurch-house-prices-up-30-per-cent-since-quakes), putting even modest houses

potentially out of reach of people on median incomes. It is beyond the scope of this article to explore this issues in any detail, but such issues clearly impact the Christchurch participants.

According to Geller (2012), Portland was as car dependent as any other US city in the 1980s and 1990s. Intensive lobbying and intervention has seen cycling participation increase by more than 500 percent in the period 1990-2010, to six percent (Buehler & Pucher, 2012; Geller, 2013), the city being awarded platinum status as a bicycle friendly community by the League of American Bicyclists in 2008. Portland has developed a reputation for embracing cargo bike use and building, with retailers estimating 600 cargo bikes to be in use in the city in 2012 (personal communications, 2012). Coincidentally, disaster preparedness is also a live issue in Portland, due to the cities positioning relative to the Cascadia subduction zone, which is thought capable of generating a magnitude 9.2 earthquake by the Federal Emergency Management Agency.

Interview data is presented, collected as part of research into the integration of cargo bikes into urban mobility practices. As an investigator, my status is to varying degrees, like most of the participants, as a driver, cyclist, pedestrian and public transport user. When this research began I did not own a cargo bike, but as the research progressed I took every opportunity presented to me to experience riding as many different styles of cargo bike as became available: I am, therefore, a participant in, and an observer of cargo-cycling. As a subset of doctoral research participants, these 25 participants were all using and/or building a front-loader or longtail cargo bike at the time of the interview to meet some of their domestic load-carrying need. The interviews were conducted either in person or via Skype, the line of questioning based upon how the participants found out about cargo bikes, the usefulness of different bike configurations, how cargo bikes were incorporated into daily routines, and how cycling interfaced with other mobility practices. Thematic analysis was undertaken using a three stage iterative process (Lee, 2015; Riessman, 2008) involving data condensation, display and conclusion drawing (Miles et al., 2014; Spencer et al., 2003). Data concerning the demographics and context of the two cities is presented in Table 9.

**Table 9 Demographic and contextual data for Christchurch and Portland**

| | Christchurch | Portland |
|---|---|---|
| Population | 341,469[19] | 619,360[20] |
| Median annual income | NZ$65, 300 (2013)[21] | US$53,230 (2010-2014)[22] |
| Average percentage of household budget spent on transportation | 14.2%[23] | 18%[24] |
| Percentage of households without access to a car | 8%[25] | 15%[26] |
| Cycling mode split | 7% | 6% |
| Number of participants | 18 | 7 |
| Gender ratio F:M | 6:12 | 0:7 |
| Age range | Mid 20s -50 | 30-50 |
| Percentage of participants with childcare responsibilities | 72% | 71% |

### 8.5.1 Affording cargo bikes

The cost of cargo bikes is a major focus of discussion, particularly in the quality, branded portion of the market. In New Zealand, rear-extender kits to convert pre-existing pedal cycles to cargo bikes currently cost in the region of NZ$700, and complete cargo bikes anywhere between NZ$1,500 and NZ$6,500. In Portland, a much broader range of cargo bikes is available with extension kits starting at US$400 and branded machines ranging from US$1,000 to US$6,750. My observations suggest that home-building might account for between 10 -25 percent of ownership in both cities (personal communication, 2012).

Many of the participants in this study have young children, with at least one partner working, and live in their own homes. The majority also match observations in other studies that cyclists are likely to have secondary and tertiary level education (see for example Danyluk & Ley, 2007). Currie and Senbergs (2007) comment that this age demographic might be expected to experience car-related economic stress as they balance the costs of a family with housing and transportation costs. Participants acknowledge that cost is a factor in justifying the purchase of a cargo bike. Such

[19] http://www.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-about-a-place.aspx?request_value=14758&tabname=
[20] http://www.census.gov/quickfacts/table/INC110214/41,00
[21] www.ccc.govt.nz/...Christchurch/.../HouseholdIncome-MedianMap-docs.pdf
[22] http://www.census.gov/quickfacts/table/INC110214/41,00
[23] https://www.newzealandnow.govt.nz/living-in-nz/money-tax/comparable-living-costs
[24] City of Portland Bureau of Planning and Sustainability. (2009)
[25] Statistics New Zealand (n.d.-a)
[26] Sivak (2013)

considerations have led participants to build their own cargo bikes, as a means of not only reducing costs but also experimenting with the technology. Where commercially built cargo bikes are purchased, their cost is justified on the basis of their functionality.

According to PO7 longtails are resurgent in Portland, partly due to increased choice at:

> a third of the price … [of some front-loaders] no contest for people not being willing to sell a car but still wanting to do short trips and having the money to buy one … the power behind movement is in longtails, not front-loaders.

PO8 sold his car to purchase his first cargo bike: for PO8 relying on a cargo bike to meet all his mobility needs, including transporting his children, allowed him to live on a lower income. Having a car to sell made this possible, but he acknowledges that without having a car to sell, despite the advantage of very low running costs it would be 'terribly hard to do'. Selling a car means 'turning an asset into a cargo-bike which makes it very easy' (PO7).

In Christchurch, CH8 remarks 'this is ridiculous, we're buying a second [longtail]!' For CH8 and her partner, their preference for cycling, need to transport their child, and their respective work commitments mean they both, during the course of the day need access to a bike to transport their child. Before the purchase of the second cargo bike, a number of additional cycling trips were being made to swap bikes. In practice terms, the rhythms of daily mobility practices were not synchronised with one cargo bike, and for this household, the purchase of a second cargo bike reconciled the household demand for mobility, by requiring only one parent at a time to synchronise with their child's mobility needs. However, making the decision to buy one, let alone two cargo bikes is still a big step for people in Christchurch, who unlike in Portland, do not live with the reinforcing images of a visible cargo-cycling sub-culture, and do not easily have access to the material resources of cargo-cycling from local retailers. As a consequence the costs of, 'off the shelf nicer bikes are hard to justify' (CH3) and some participants build their own or take advantage of serendipitous events such as when CH5 'stumbled across' a half price longtail in a bike shop. While for CH8's and CH3's hillside households, the extra cost of E-assist is a must in making cargo bikes a workable solution, for CH11 it is an option for later – 'to be honest it's the price, it makes us think we'll see if we can do without it first'.

The decision to use a cargo bike is frequently associated with having children, but this is also a time of increased household costs. Building a cargo bike reduces costs, and facilitates experimentation with practice configurations, making participants with building capabilities "recruitable" to cargo-cycling. For those purchasing a commercially produced cargo bike, the perceived and realised use-value across a range of economic and social factors impacts the decision-making process. Purchase may be justified or achieved, as in PO8 and PO7's cases on the basis of selling a car. Alternatively, car running-cost reduction or avoidance of second car purchase become justifications for cargo bike purchase.

### 8.5.2 Cycling and driving – overcoming lock-in

Walker (2013) suggests that uptake of less carbon-intensive mobility technologies will be conditioned not only by socio-economic status but also the degree to which people are locked in to pre-existing forms of mobility. A binary opposition is often formulated between drivers and those assumed to be non-drivers (Bacchi, 2009), which closes off consideration of more nuanced relationships between driving and cycling practices. Cargo-cycling does not necessarily imply forgoing driving. Only two male participants are completely car-free, both having no dependents and long-standing involvement with bike messengering and cargo bike logistics.

Cycling as an activity matters to the participants, but for participants in Christchurch and Portland, cars are a crucial element of longer-distance travel, as out of towns 'public transport is very limited in New Zealand' (CH3). Cargo bikes facilitate the pragmatic negotiation of need for driving for local trips to transport children, grocery shop, collect bulky items, and facilitate local family leisure:

> We have a car for long distance trips … until we had a child we only fuelled it a few times per year … we use it a bit more now but the bikes are still used for closer trips (CH4).

Further, cargo bikes are identified by practitioners as functioning as, or replacing the need for, second cars for shorter trips:

> We have one car which we seldom use. This was a good option to avoid a second car … When I first got the bike I went to huge lengths to move everything on it - I'm not going to bloody drive now I've got this cargo-bike. I'm probably a bit more pragmatic now if it's seems like a lot of hassle … it might be one of those occasions where I need to drive … as a rule, I would always ride rather than drive ... As a family for trips generally, the bike would be the first option (CH5).

> Previously, when we were both working we only used our car at the weekend … but now I'm pretty much every day … I have to use the car to go to the supermarket because I can't carry … [the baby] on my usual bike yet. We're

> getting our head around that we're buying a second car rather than a bike, it's the price bracket we're imagining in … we don't need two cars … I don't like using the car every time, so it's more a replacement for the car rather than a bike. We'd definitely not get rid of our car because we still … do all those holidays, the out of town travel (CH11).

The trip range of cargo bikes is extended when E-assist capability is added. For one participant, E-assist 'means I'm using my bike more … it's the best thing since sliced bread!' (CH8). In Portland, PO8 and his partner both work out of the city and use a car for their commute, but local shopping and child transport is all achieved by cargo bike. PO7 was riding a regular bike when he got to know a cargo-cycling family:

> they were riding their cargo bike constantly, even through the winter which cemented the idea for our family … it wasn't very long after [our son] was born that we sold my Honda Accord Wagon, and drove to Seattle to get our first cargo-bike.

For PO7's household, being presented with images of the achievement of cargo-cycling in adverse weather was a pivotal point in their recruitment to cargo-cycling. Many participants were already recruited cyclists when they came across cargo bikes, and all of them owned or were using a pedal cycle for either utilitarian and/or recreational purposes. For one participant, moving to the flat parts of Christchurch was the catalyst to start cycling seriously five years ago, the terrain, linking with images of cycling as "doable":

> It was a novelty up until then. I like the idea, so if I'm ever going to do it, this is the place, so I committed to it then and it's been great' (CH11).

The majority are also in relationships with partners who cycle, reinforcing images of cycling as achievable, and the rhythmic affordances of cycling. However, household cycling/driving practices are also revealed as dynamic, both within households and in the combining of activities around cycling or driving. Thus, while one person in a household might tend to drive and another cycle, these performances were also negotiable between householders. This negotiability between mobility practices is further examined in the next section, in relation to the material affordance of cargo-cycling.

### 8.5.3 Functionality for combining tasks

Historically, reasons cited for using cars to make short trips have commonly focused on the freight function of travel (Anable, Mattioli, & Vrotsou, 2014) - carrying heavy goods such as shopping and giving lifts to other people, time constraints, and trip-chaining (Mackett, 2003). Many households require two incomes and two cars, for commuting, work and household functions, including transporting children, shopping, and visiting relatives (Cahill, 2010). Driving has been argued to be a tool

which helps to overcome the time poverty often associated with combining multiple tasks. Participants in this research are primarily people going about their normal daily lives, using cargo-cycling as a tool to widen their conditions of cycling possibility (Nettleton & Green, 2014), helping them to achieve multiple tasks without driving. In Portland, a car-free participant was drawn to cargo bikes by 'pure carrying need' (PO9). PO2 a Portland-based stay-at-home father for two years, bought his first cargo bike to enable him to use a bike for everything.

Homebuilders' cargo bikes are usually built to meet specific needs and budgets and vary in design and elegance. In Christchurch, CH4's front-loader is used for shopping and child-carrying and has become his pedal cycle of choice. For CH6 and CH7 their cargo bike, built mostly from recycled materials for around NZ$150, 'isn't the most used bike in the shed' but for CH7 it is the most used bike as she 'can't go anywhere without the kids … It has a specific purpose and it works really well for that purpose' – carrying the children and shopping. CH6 also uses it for a purpose, taking things to work that would be too big for a road bike. CH3's and CH9's unfinished (partly due to the prolonged process of post-earthquake house repair in Christchurch) longtails have been designed as multi-purpose units for encumbered activities. Both consider the longtail design more versatile, in integrating with multiple mobility practices in the long term, when they no longer need to carry children.

For one couple a commercially built longtail was the best option to transport their son once he got too big for a baby seat on a conventional bicycle:

> I need to be able to carry a kid and carry stuff at the same time … Nothing was meeting our needs if we wanted to take a kid safely on a bike … we thought about the Christiania [cargo-trike] but man the manoeuvrability! … and how the hang are we ever going to get that up the hill … some people we knew had a cargo-bike [longtail], we went and did a test ride … it was a woman, that's how she took her kid to school … she was totally enthusiastic, said 'this is awesome, we can take the kid to school, we can bring another kid home for a play date, and I can do my shopping as well'. It felt safe, it was easy to ride. We got one, and I loved it! (CH8).

For CH8 the longtail has become her preferred mode of transport, even when not carrying her son, supporting CH3 and CH9's images of longtail use. In practice terms, CH8's description brings together not only the hybrid materiality of the bike and rider, but also the distributed competence of the two, to achieve multiple task synchronicity, and images of safety, task accomplishment, and well-being. CH5 also uses his longtail to shop and has been carrying his daughter since she was six

months old. Having been saving for a more expensive longtail, he eventually purchased a cheaper brand when he came across it at sale price: whilst functional he realises that it has some design limitations, including leaky panniers and overly large wheels, while his preferred, more expensive brand would not have been subject to these limitations. Likewise, CH2's longtail is reasonably heavy and single speed meaning that he uses it for specific purposes such as carrying his children to sports, but it is not his bike of preference for other activities. For these practitioners affordability and/or availability constraints have resulted in purchases which see a trade-off between design and function, which have limited the number of practices with which cargo-cycling can reliably and consistently mesh.

A participant and her partner were at the time of the interview, contemplating the purchase of a cargo bike from a friend who had originally introduced them to cargo-cycling in Copenhagen:

> We used it to take his kids to day-care and to collect building materials and we thought they were great, and the fact you can move house without a car kind of blows your mind … it just made so much sense (CH11).

They like the three-wheeled cargo-trike because it 'looks safe for both me and my children, and can carry the large amount of stuff that goes with kids and everyday … around the shops' (CH11).

Both CH11 and her partner would be using the cargo-trike, and have used it to transport adult friends, but:

> primarily it needs to work for me because I need to feel confident using it, otherwise I won't use it … because I'll be the one carrying … [the baby] around a lot … I would definitely argue to myself that [a trip into town] is definitely manageable every time [by cargo bike].

In SPT the elements of a practice rather than the whole practice are understood to travel in space and time, to be configured in nuanced but recognisable performances of the entity in new locations to conform with local conditions (Shove et al., 2012). For CH11 and her partner images of safe and versatile cargo-cycling from Copenhagen are combined with the material entity, a Danish built cargo trike, and the competence to safely carry their baby in Christchurch, incorporating, for instance, the local infrastructure constrained by earthquake repair works, with ramifications for the well-being of the parents and child.

### 8.5.4 Beyond transport – personal and community well-being

As already alluded to, it is not just the capabilities of cargo-cycling which draw people; there are also specific personal and community meanings associated with their use, a sub-cultural identity in a community of practice, where practice-variants have the potential to both attract new practitioners, and revitalise existing practitioners to reduce defection to competing practices. A long-term Portland cyclist reflects:

> A lot of it is based on use and need … but there's a subgroup culture that comes with it … the people that you meet within that group, there's something about their draw to that bike style that makes them just wonderful people, oftentimes family, they're very giving, they're very supportive. As much as I like the cargo-bikes, I like the people within that community equally as much (PO8).

As CH11 and CH8 found after the birth of their children, when they became car-reliant, not being able to cycle when it is your normal mode, and most of your friends cycle is socially isolating and undermining of well-being.

> It's about mental health, it's good for us, well good for me … how I process my day at work as I bike home … so it's we've got a kid, how do we keep cycling? That was that whole oh my goodness we have to buy a car and it was awful, I didn't go by bike for the first months of my sons life because you've got this baby all the time … oh my goodness, once we could get him on the bike, phew! Freewheeling down the hill again yay! (CH8).

Both CH8 and CH11 found the first six plus months of their children's lives changed the way they had to practice mobility: they felt constrained into driving. Once their children were old enough, they were quick to find a mechanism to transport their children by pedal cycle. A cargo bike meets that need: in practice terms, cargo-cycling performances for these practitioners include elements of well-being, which do not form part of their driving practice. CH10, as primary caregiver, spends time each day riding with his children on one of his home-built cargo bikes. He is very enthusiastic about the sense of community generated by people not being in cars, and the number of random conversations he and his children have with people when they are out and about. Thus, in his, and his children's cargo-cycling, images of personal and community well-being form part of their performances.

Similarly, reflecting on his own and other's well-being, another participant says:

> Cars… they're not inherently bad if you want to go long distances and carry lots of people they're ideal, but it just doesn't make sense to me. On a health level, I don't really believe in exercising, let's lead more integrated lives, it's a no brainer for posture, the cardiovascular system, pollution (CH5).

Thus, while accepting the benefits of driving in particular circumstances, cargo-cycling is for these practitioners, a mechanism to preserve the well-being they associate with cycling, which at the same time challenges normalised conventions of load-carrying and child-rearing circulating around driving.

## 8.6 Negotiating mobility 'need' – the relationship between cargo-cycling and driving practices

The previous section explored the doing of cargo-cycling in Christchurch and Portland, two cities which embody high car use characteristics despite by Anglophone standards also exhibiting relatively high cycling modal share. Adopting a SPT approach facilitates examination of the relationship between driving and cycling, a relationship influenced by the demand for mobility to fulfil day-to-day need for load-carrying and commuting activities. While this emphasis raises a number of issues worthy of consideration, here the analysis is confined to three main points, the performance of cargo-cycling, the affordance of mobility, and the maintenance of well-being.

SPT focuses on the doing of practices and the changing relationship between practices. The justification for interviewing these participants lies in their ability to talk about that *doing* (Hitchings, 2012) of cargo-cycling in Christchurch and Portland, as early adopters of this variant of cycling practice. This is particularly true of Christchurch where my informed guestimate would suggest that the participants comprise between 35 and 50 percent of the cargo-cycling practitioners at the time of the study. These practitioners sit at the overlap between cycling, driving, shopping, commuting, child transportation, and other day-to-day activities. The temporal and spatial rhythms of the multiple practices they perform on a daily basis are conditioned by the range of elements that are present in the spatial and temporal locations that are Christchurch and Portland in the 2010s. As Maller and Strengers (2013) show, people who travel and migrate are exposed to a wider range of practices than more sedentary populations. Virtual travel in the digital and media domains is also an important component of this "travel" exposure to practices. The practitioners in both cities have been recruited to cargo-cycling to varying degrees, by their own and friends travel practices to countries including Denmark and the Netherlands, the physical circulation of material elements, the competence they embody, and the digital and traditional media based circulation of cargo-cycling affordance. Such images tend to emphasise the commonalities of material load-

carrying competence embodied in cargo-cycling and driving, as articulated in references to cargo bikes as the SUVs, minivans, and station-wagons of cycling (see for instance City of Copenhagen, n.d.-b; Farnham, 2013; Vanderbilt, 2013). However, without the presence of the material affordance of cargo bikes and their associated paraphernalia, cargo-cycling cannot be practiced. Early adoption in Christchurch has been constrained, in a manner seen in earlier years in Portland, by the rarity of commercially produced cargo bikes. Consequently, early uptake of cargo bikes also sits at the intersection of home-building and load-carrying mobility related practices, which also partly overcome cost constraints.

Cost is clearly identified as restricting the possibilities of recruitment to cargo-cycling. Such issues are comprehensively examined in the social exclusion and car dependence literatures, but thus far poorly addressed in theories of practice, which are more focussed on diagnosis and analysis than foregrounding equity and social justice (Walker, 2014a). This then is where I argue, these literatures can come into useful diagnostic and explanatory tension. The car dependence literature identifies the pressures of car ownership in hypermobile cities for households when car ownership becomes an item of household expenditure that cannot be foregone (Banister, 1994), particularly when coupled with housing pressures. Car-related economic stress is argued to impact low- and moderate-income households, and for many households, even on low incomes, in car-centric countries like New Zealand and the US, ownership of two or more cars has become nearly as non-negotiable as the ownership of one car (Hickey et al., 2012). In Christchurch, post-earthquake housing costs and many of the participants having young families, a life stage acknowledged to increase financial constraints and car dependence, impact the affordability of second cars *and* cargo bikes.

Cycling is generally regarded as affordable, costing 'far less than both the private car and public transport, in direct user costs and public infrastructure costs' making it 'among the most equitable of all transport modes' (Pucher & Buehler, 2008b: 496). However, pedal cycle activists see pedal cycles as more than transport 'as literally a vehicle of social change' (Cox, 2013: 122), but such qualities are potentially mediated by capital cost. Cargo bikes (particularly when incorporating E-assist technology) are positioned in terms of range, payload and cost, between and overlapping with bicycles and cars (Gruber et al., 2014), but 'cost hardly anything to use' (Crawford, 2012: 60). Here it is possible to draw some parallels with the emergent potential of electric vehicles: cargo bikes share low running costs and environmental benefits

with electric vehicles, but in both cases, access to these savings is contingent on not being locked-out by the capital cost of access to these long-term economic and environmental benefits (Walker, 2013). It is clear that for the majority of participants, in both cities, the purchase of a cargo bike is hard to achieve within the household budget. For those who already have a car, realising that asset can facilitate the purchase of a cargo bike. However, most participants have a more complicated relationship with driving, whereby different practices are accomplished by different modes.

The FCO literature, in questioning the relative advantage/disadvantage of car ownership, like SPT, treats driving, at least for load-carrying and commuting, as largely a matter of derived demand for mobility to access services. Accordingly, the rhythms and level of synchronisation of the bundling of practices conditions the need for different forms of mobility, with affordability impacting the range of elements that can be brought together in a practice and the range of practices that can cohabit successfully. The easiest route to cargo bike ownership appears to be where a second car, as a realisable asset, is sold to facilitate the purchase of a cargo bike. Some of the fixed costs of car ownership are, therefore, maintained while daily running costs are reduced by cargo-cycling. However, as a number of participants in Christchurch comment, second hand cars are 'too cheap' in New Zealand making the capital costs of cargo bikes appear an expensive option. The costs of cargo bikes and second cars are still treated by cargo-cyclists as being in the same order of magnitude, rationalising cargo bikes *as* second cars - 'it's more a replacement for the car rather than a bike' (CH11).

Recruitment and defection to and from cargo-cycling or driving is also constrained by, competition for finite practitioner time resources, and through competing images of, for instance, safety, health, environmental responsibility, convenience, and social status (Shove, 2012; Watson, 2012, 2013). While cargo-cycling has environmental benefits over driving, cargo bikes, particularly in their front-loading form take up more space, on and off the road, than conventional pedal cycles. Consequently, they also compete for urban space. In Copenhagen, parking for the 678,000 pedal cycles, 40,000 (6 percent) being cargo bikes is recognised as posing a major challenge (City of Copenhagen, 2015), particularly as in Copenhagen around 80 percent of those cargo bikes are thought to be the larger three wheeled front loaders (http://www.copenhagenize.com/2015/10/cargo-bike-nation-copenhagen.html).
The Portland City Bike Plan (Portland Bureau of Transportation, 2010) acknowledges

the operational characteristics of cargo bikes and the need to incorporate these in cycle planning. However, as identified by PO7 in Portland, the less bulky longtail cargo bikes, a design originating in the US and UK, carry the competency and images, which are most closely matched to load-carrying need in New Zealand. Thus, while post-earthquake road conditions in Christchurch can still be challenging and congestion inducing, competition for urban space is an element of cycling per se rather than an issue particularly noted by the small numbers of cargo-cyclists.

The association between time-poverty and well-being is established in the literature as a core element of car dependence, affecting the well-being of the socially advantaged as well as low-income households. Time-poverty is associated with traffic congestion, and in highly congested cities cycling is often faster than driving. In Copenhagen, the most common reason cited for cycling is that that it is faster than alternative modes and therefore saves time (City of Copenhagen, 2013). While some cargo bikes are slow, heavy, and less manoeuvrable than conventional pedal cycles, the longtails, and front-loader designs more commonly seen in the US and New Zealand, especially when combined with E-assist technology, have the ability to move and manoeuvre at a pace as fast, or faster, than motorised traffic in congested city streets This sort of rationale for cycling, presents time as well as space as a scarce resource, with practices competing for that resource, and with efficiency based upon effective practice sequencing and coordination. The participants in this research also highlight another aspect of time and space in relation to well-being, which can be expressed in terms of a making of time for well-being, such as the processing of the working day whilst cycling. This making of time (Shove et al., 2012), can sit alongside the time-saving attributed to cycling, where well-being is enhanced for the participants in this study, by facilitating mental processing, engaging in physical activity, and sharing a mode that is favoured by friends and family - a sociality on the streets.

Academic scholarship and social media assert that making cycling more accessible and attractive to women is crucial in growing utilitarian cycling (Baker, 2009; Walks et al., 2015). In the Netherlands and Denmark, riding a pedal cycle is a normal everyday practice 'a tool for getting around' (Cox, 2015b: 5), rather than a deliberate lifestyle choice. In Copenhagen, where more women than men cycle, 26 percent of all households with two or more children have a cargo bike, and in 17 percent of households with cargo bikes, the cargo bike replaces a car (City of Copenhagen,

2013). Joe Doebele, a Portland-based cargo bike retailer, observes that when he started selling cargo bikes in 2008, he thought they would be bought to carry goods, 'but parents, mostly moms, were the ones who were buying them … it quickly became a family bike' (Vanderbilt, 2013). The first cargo bike retailers in New Zealand also report that the majority of purchasers are families.

Women participants in Christchurch make clear the associations between maintaining cycling and personal well-being: for these women, cargo-cycling is their only route to meeting that need with young children, as they 'can't go anywhere without the kids' (CH7). The birth of children, even for hitherto regular cyclists is identified to be a tipping-point, particularly for mothers, where the normalisation of driving becomes very hard to negotiate for day-to-day mobility, and at least a temporary lock-in to driving can be precipitated. While women continue to be the main bearers of the combined responsibilities for childcare and household provisioning, the increasing availability and recognition of cargo-cycling as a conduit for practice bundling, and as a means of enhancing well-being has the potential to unlock some practices from their symbiotic relationship to driving. The cargo bike, as the so-called "minivan" of the pedal cycle world, offers capabilities, normalised as car properties, for combining the carriage of children, shopping and other goods with the ability to commute and meet other daily practice commitments. For people who combine cargo-cycling with driving as mechanisms to meet their day-to-day load-carrying needs, both practices can combine images of desirability and status, which are fluid rather than fixed elements of cycling (Cox, 2015b).

Thinking about the spatio-temporal characteristics of practices leads to the obvious but important conclusion that not all practices can or need to be practiced everywhere, within the 'uneven landscapes of possibility' (Shove et al., 2012: 132). For the participants in this research, despite assumptions such as those indicated in the Christchurch Press article, cycling and driving are *both* part of the accomplishment of mobility. However, for a practice to develop and grow, not only do the materials, competences and images have to be present but those elements have to be visibly linked by early adopters as exemplars of an alternative practice, and showcased in public activities (Birtchnell, 2012). In particular, the disruption to household rhythms associated with the birth of, and caring for children is strongly associated with recruitment to cargo-cycling.

In practice terms, recruitment to cargo-cycling as a practice-variant has in Portland occurred in parallel with recruitment to cycling. While more trips are being accomplished by pedal cycle, and there is evidence of a reduction in car ownership and use in Portland (Sivak, 2013), for households with children, cargo-cycling seems to represent foregoing second car ownership, rather than driving per se. A similar trend in affording cargo-cycling is observed in Christchurch, although a more subtle relationship between cycling and driving is expressed than simple competitive relations. For these practitioners, cargo-cycling affords the persistence of cycling as a localised load-carrying practice, but in most cases does not negotiate away driving as a means of achieving other, geographically more distant multi-person activities. Thus, in places where owning more than one car has become close to a condition of participation, cargo bikes, once afforded, have the potential to significantly reduce the proportion of the weekly budget that has to be dedicated to mobility. If, as Mullen and Marsden (2014) point out, a core question regarding participation in society, is how to move on from identifying inequalities to proposing solutions, then we need to understand not only how people do practices in the now, but also how changing conditions of possibility might influence doing in the future. Understanding how cargo bikes can and do fit in to mobility practices opens possibilities for intervention, where cargo bikes can form part of a more equitable and sustainable transport system. Finding alternative ways of affording decarbonised mobility requires looking at how problems such as affordability are framed, and seeking alternative solutions which challenge existing conceptions of what it is to 'do' mobility. These might involve exploring solutions, which for instance incorporate aspects of collaborative consumption, community ownership, and resource sharing practices. For those currently experiencing lock-out from decarbonised, sustainable and equitable mobility practices, such solutions need to embody a capacity to do decarbonised mobility, which does not exacerbate existing inequalities, and perpetuate exclusion from the decarbonised mobility 'clubs' partly constituted by cargo-cycling – a challenge worthy of investigation.

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## 8.7 **Practice summary**

The visual representation of the practice dynamics zoomed in upon in Chapter 8 (Figure 8-2) presents a relationship between cargo-cycling, child transportation driving and longer distance travel. Rather than the more binary relationships

suggested in previous chapters, here the nuances of relationships between cargo-cycling and driving are expressed, mediated by relationships with other practices.

The confluence of driving and cycling is expressed where second car ownership is foregone to afford cargo-cycling as a means to achieve primarily child transportation. However, where periodic cross-cutting long distance travel is to be achieved cargo-cycling no longer congeals with the demands to carry children, passengers, and goods requiring driving to remain part of the practice mix. While car ownership is not necessarily required for driving to occur, in locations where for instance car sharing practices are not prevalent, such as Christchurch, car ownership remains a mechanism for affording driving.

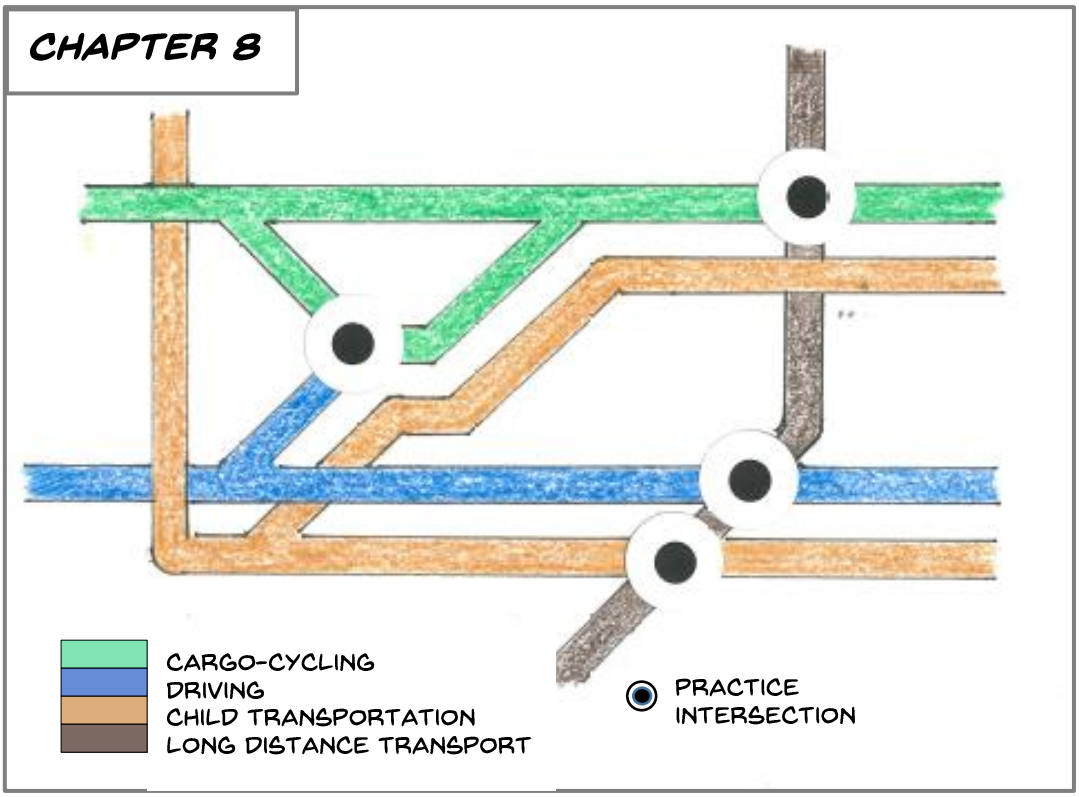


**Figure 8-2 Chapter 8 practice summary**

As the final chapter in Part B, Chapter 9, in developing some of the themes raised in earlier chapters, commences the zooming out process completed in Part C. As a more speculative chapter, the hybridity of transport modes is placed in tension with the bifurcation of products discussed in terms of flexibility, and the freight function of travel.

# Chapter 9 Rethinking mobility - the cargo bike as trans-mode

## 9.1 Introduction

Despite multiple attempts to encourage the use of public and alternative transport modes in preference to private car use, resistance to such change remains, and car driving continues to dominate mode share in many Western towns and cities (Kent, 2014; Sheller, 2012). This preference has been attributed to a number of factors including issues of utility, reliability and time-saving, and the fulfilment of emotional and symbolic needs, as part of the operation of a socio-technical system of automobility (see for example Kingsley & Urry, 2009; Sheller & Urry, 2006; Urry, 2004). Meanwhile, culture and habit are argued to foster cycling in cities with pre-existing high rates of cycling, but equally, those factors are also argued to deter cycling in low cycling locations, particularly for those who do not currently cycle (Buehler & Pucher, 2012: 41). Consequently, answering the question 'What would it take for cycling to displace driving as the dominant practice in personal mobility?' (Watson, 2013: 117), is challenging.

However, evidence from some OECD cities suggests that over the last ten years increasing numbers of people have been walking, cycling, and using public transport rather than driving (Delbosc & Currie, 2013; Goodwin, 2012; IPCC, 2013; Kuhnimhof et al., 2013; Newman & Kenworthy, 2011). While this change is most evident in younger people, they are not the sole contributors to this trend (Kuhnimhof et al., 2013). This change has been partly captured in the peak car literature, which engages with 'the observation of slower rates of growth, levelling off, or reduction, in various measures of car use, which have been seen in many, though not all, developed countries' (Goodwin & Van Dender, 2013: 243). This literature presents evidence that car-use is based upon factors which include policies as well as driver preferences, financial constraints as well as choice (Goodwin & Van Dender, 2013), and alternative transport availability, affordability, and household location (Delbosc & Currie, 2013; Grimal, Collet, & Madre, 2013).

The relationship between cycling and driving is held to be interdependent but inherently competitive, with pedal cycles being argued to not 'simply substitute for cars' (Watson, 2013: 118), at least partly because driving and cycling practices 'fit into the spatial and temporal requirements, and purposes, of practitioners, lives in very different ways' (pp. 118-119). Here, I advance a more nuanced argument based

upon the bifurcation of cycling practices, and the hybridisation of personal transportation focused on the incorporation of cargo-capable bikes into load-carrying practices. This exploration is influenced by the idea that the pedal cycle can be thought of as a type of car or that conversely 'the car is a type of bike' (Shove, n.d.). Such assertions suggest that '[d]riving is, therefore, a form of cycling' (Shove, n.d.), or cycling a form of driving, there being a sharing of infrastructure, meanings, and competences between the two practices. I use these provocative propositions to stimulate speculation on the transmodality of cargo-capable bikes as hybrid forms which in some ways represent 'adding a boot' to a pedal cycle to make it 'closer in this respect to a car' (Shove, n.d.). Applying these ideas specifically to cargo-cycling provides a mechanism to think about daily mobility practices that involve load-carrying, and their enmeshment within a suite of other daily practices, in a use-centred rather than innovation-centred analysis (Edgerton, 2007).

To speculate on such relationships I draw on resources which include: advertising and social media representations of cargo-capable bikes as car replacements, a social constructionist approach to the history of technology, and recent scholarship informed by practice theory on the freight function of travel and flexibility of demand. The empirical dimension of this paper is derived from in-depth interviews with cargo-cyclists in Christchurch, New Zealand, and the US city of Portland, Oregon, particularly focussing on how day-to-day practices are grouped around cargo-cycling. Reflecting on the experiences of the participants, I explore the rethinking of mobility based upon a subversion of dualistic thinking, to focus on affinity and continuity, rather than categorical distinction.

## 9.2 **From pedal cycles and cars to cycling and driving**

Evidence of a subverting of categorical distinction between cars and pedal cycles can be found in the advertising and social representations of contemporary models. Cargo bikes are increasingly referred to as the SUV's (City of Copenhagen, n.d.-b), minivans or station wagons of the bike world, referencing their ability to transport significant freight or passenger payloads when compared to conventional bicycles. This positioning is reinforced as cargo bike designs bifurcate to incorporate larger and more varied payloads, the sort of hybridity of form alluded to by Shove (n.d.).

One development of the observed creative tension between hybridity and bifurcation of form of cargo-capable pedal cycles can be observed in the development of semi

enclosed, semi-recumbent cargo-capable bikes which suggest a hybridity of form between pedicabs and velomobiles. This, however, is not a new phenomenon. For instance, in France in the early 1920s, Charles Mochet designed the two-seater, four-wheeled pedal machine he called the Velocar (Figure 9-1), an aerodynamcally advantageous recumbent alternative to the conventional bicycles of the time, which incorporated cargo capacity (Schmitz, 1990), pedals for both occupants and an optional 100cc single cyclider engine. Mochet was not alone in producing pedal cars, manufacturing approximately 6000 pedal cars between 1925 to 1944, alongside small lightweight cars (Van de Walle, 2004). The pedal cars had an affordability advantage over cars, at a time when very few people could afford cars (Schmitz, 1990; Van de Walle, 2004)

**Figure 9-1 Mochet Velocar**
(source: http://www.lanemotormuseum.org/collection/cars/item/mochet-velocar-1931?highlight=WyJtb2NoZXQiLCJtb2NoZXQncyIsIm1vY2hldHMiXQ==)

Contemporary designs of these semi-enclosed cargo-capable pedal cycles are marketed in Europe and the US, but at the time of writing only one is being retailed in New Zealand. - the Organic Transit Elf™ (Figure 9-2). Marketed as 'in-between a

bike and a car', and as 'eco-friendly bike-cars' (organictransit.com), elements of the design and functionality converge visually and discursively, not only with cargo capability but also with another segment of the car market - the small urban focused cars such as the smart™ car (Figure 9-2). Marketing positions the Elf™ as part of a continuum which combines car like qualities with a machine that supports physical activity but without sacrificing freight function and weather protection. The Elf™ also combines human-power with optional and controllable levels of solar charged E-assist. Such trikes (and bikes) have mostly been used to date by cycle logistics companies delivering freight by bike, and pedicab operators, but are increasingly being marketed for decarbonised personal transportation. Smart™ cars and their counterparts from alternative manufacturers can meanwhile be recognised as part of a bifurcation of car designs marketed as fun, agile, having a small turning circle, and easy to park (http://int.smart.com/en/en/index/smart-fortwo-453.html).


**Figure 9-2 Smart™ car (left) and Elf™ E-assist trike (right)**
(source: http://www.smartaustralia.com.au/au/en/index/smart-fortwo.html and http://www.quikes.co.nz/elf-2fr-copilot.html)

In reflecting on these initial visual and discursive elements of cross-over between driving and cycling as embodied in vehicle attributes, and in identifying hybridisation and bifurcation in the elements of cycling and driving practices, scholarship from the field of science and technology studies is illuminating.

### 9.2.1 The social construction of technology

Cox and van de Walle (2007) identify flaws in linear evolutionary accounts of cycling history (see for instance Herlihy, 2004) which position the contemporary diamond framed bicycle as the pinnacle of pedal cycle design. Applying a social constructionist approach to the history of technology (Bijker, 1995), which emphasises socio-cultural, economic and political influences, Cox and van de Walle seek to challenge the positioning of the automobile as the ultimate form of personal

transport, and to rescue non-automobiles from narratives of marginalisation, positioning them as viable, appropriate, and sustainable modes. Cox and van de Walle thus reject the retrospective separation and segregation of transport types they observe in pedal cycle histories, arguing that this positioning misses 'important linkages and commonalities between transport technologies' (p. 117) such as manufacturing and technological overlap. As a consequence they argue for accounts of personal transportation based upon a 'continuum of transport types and technologies, understanding them not as categorically distinct from one another, but as interlinked parts of a greater set of possibilities' (p. 117).

In developing personal transportation accounts, Cox and van de Walle offer a relational model of transport modes (Figure 9-3) which in effect cross-tabulates the motive power sources and level of enclosure of a number of personal transportation types. The model, in expressing a range of enclosure and motive power, seeks to counter discourses of cycling depicting an old and marginal technology, instead emphasising commonalities rather than differences, and countering perceptions of E-assist pedal cycles as lacking purity and consistency with non-motorised forms of transportation. The range of cargo bikes now available was not incorporated in Cox and van de Walle's original model: Figure 9-3 has, therefore, been adapted to reinforce those commonalities and the range of cargo bikes now found within the cargo bike continuum.

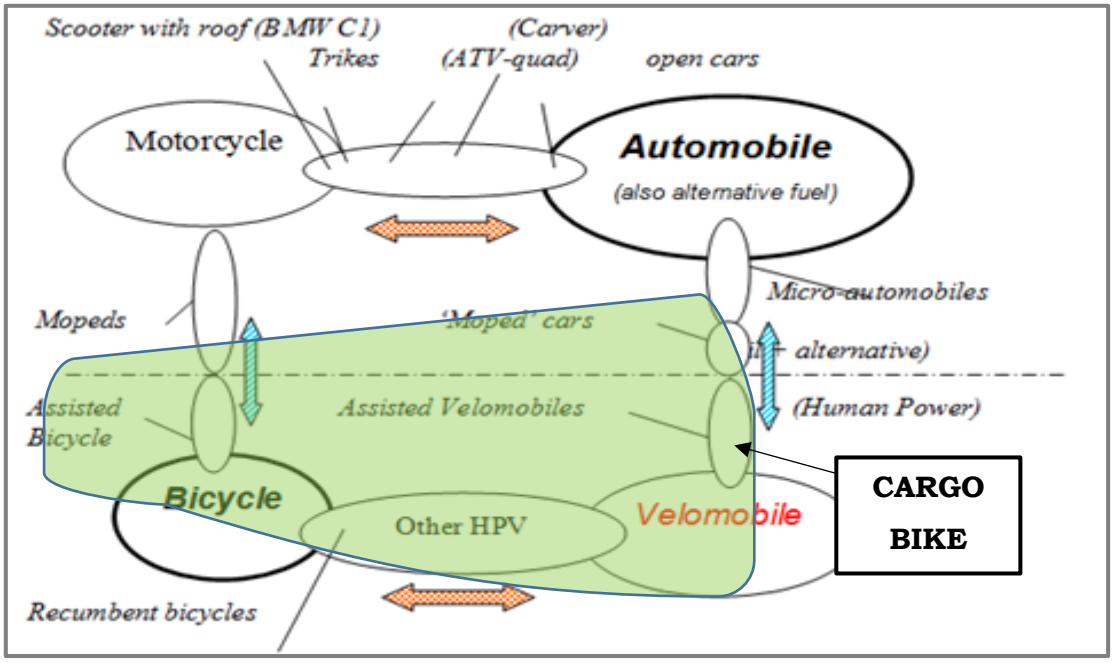


**Figure 9-3 Relational model of modes**

(adapted from Cox and van de Walle (2007: 128))

In a later paper Cox (2012) performs a similar relational modelling exercise "mapping" types of pedal cycle based upon function, incorporating three axes - power, efficiency and carrying capacity (see Figure 2.1). Cox clarifies that the variations depicted do not represent better cycles, but instead relate to the transport niches to be filled - 'solutions tailored to different applications' (Cox, 2012: 7). This filling of niches can be seen in Gruber, Kihm and Lenz's (2014) evaluation of E-assist cargo cycles in courier services where they find that 'in terms of cost, payload, and range, electric cargo bikes lie in between two existing modes (bikes and cars) and *have a largely overlapping market*' (p. 53 my emphasis). This they suggest is partly because the market for currently available electric cars is limited (Gruber et al., 2014) whilst also suggesting opportunities for the reconfiguration of urban transport in more sustainable directions.

### 9.2.2 The flexibility and freight function of travel

A way of understanding and rethinking mobility is to consider mobility as derived demand, and mobility practices as enablers of activities. The travel studies literature concentrates on understanding single journey daily mobility patterns, such as commuting or travelling to school, using data collected from activity and travel diary surveys (see for instance Geller, 2013; Witlox & Tindemans, 2004). However, practices do not exist in isolation, with multiple sequenced activities occurring through travel throughout the day. A practice based perspective suggests that resources are consumed in order to perform the practices that make up everyday life such as cycling, driving, shopping, or cooking. The social and technical significance of the introduction of new technological resources, therefore, depends on how they are positioned relative to pre-existing practices: patterns of demand can consequently be understood as *traces* of interacting practices (Browne, Medd, & Anderson, 2012: 1032). On this basis, assertion of household need of a car, and for households with children, the extension of that assertion to the need for a larger multi-purpose vehicle (Smith, Hirsch, & Davis, 2012) could be uderstood as a trace of the intersecting mobility-reliant practices of a household.

Anable, Mattioli, and Vrotsou (2014) have investigated the mobility intensity of practices by identifying practice proxies from the flows of activities in time-use data. They identify car dependent practices as:

> Practices where the car has become the dominant element in the integration between the different elements (materials, competences, and meanings, along with timing and location) (slide 7).

According to this definition, the substitution of other modes for car driving would significantly affect or stop the performance of an activity flow: restricting the transportation of objects (materials), requiring the learning of new ways of doing things (competences), changing the frequency/timing requirements, and challenging notions of comfort and convenience (meanings). Anable et al. find that high modal share and mobility intense activities include a number of forms of shopping and accompanying children, with increasing numbers, bulk, volume or weight of purchases corresponding to increased car modal share. They also find that sequences of activities strongly associated with car travel can be identified. Both of these findings have implications for flexibility.

In practice terms flexibility can be thought of as a way of 'working with or around the rhythms, conventions, economies and capabilities of practices' (Powells, Bulkeley, Bell, & Judson, 2014: 44), the level of flexibility varying between entities, between performances, and within interlinked groups of practices (Nicholls & Strengers, 2015), all influenced by the number of people performing or impacted by the practice (Powells et al., 2014). Powells et al. argue that flexibility (the how, when and where of demand and supply) is a characteristic of particular practices, with tighter rhythms associated with more homogenous performances. Anable et al.'s (2014) findings are consistent with Browne et al. (2012) who suggest that the more rhythmically in tune suites of practices become the more they are coordinated and seen to operate in stable suites of practices. Hence, a shift in one practice will affect the dynamics and coordination of others within the suite, potentially disrupting the synchronisation (Shove et al., 2009: 10). It would logically follow that a practice with greater capacity for synchronisation with multiple other practices will be advantaged in a competitive and dynamic process of practice recruitment, maintenance, and defection. Further, the shared pulse of household members – the times and places where rhythms cross (Powells et al., 2014: 47), means that collective practices 'depend on coupling and uncoupling the paths of all 'partners', implying so called coupling constraints' (Røpke & Christensen, 2013: 54). These restraints can only be overcome if household members can achieve sufficient synchronicity in their activities (Powells et al., 2014; Røpke & Christensen, 2013). However, as Trentmann (2009) notes, disruptions have the potential to reveal the flexible side of routines thought of as intractable.

## 9.3 **People talking about their practice**

In furthering this analysis I draw upon semi-structured interviews with cargo-cyclists in Christchurch and Portland to scrutinise the qualities of load-carrying practices related to notions of flexibility and cargo-capability. In New Zealand, a smaller range of commercially built cargo cycles is available than in Portland. Probably as a consequence of this limitation commentaries by participants in Christchurch tend to make comparisons between generic designs such as between longtails, trikes, and front-loaders. In Portland, comparisons are more often between specific brands and models, partly because households that have adopted cargo-cycling often own more than one cargo bike, usually of different brands. Further, the availability of multiple models in Portland, and the greater absolute numbers means that potential purchasers have more opportunity to test-ride a range of pedal cycles before purchase.

The enabling of flexibility is closely associated with the perceived freight function of the cargo bikes the participants have access to, with descriptions of flexibility and function resembling discourses on the relative merits of brands and models of cars, particularly by Portland-based participants. PO8, for example, has owned at least four cargo bikes, and at the time of his interview had three in his household. Even though he normally likes to carry a child on a front-loader, a longtail is his choice for carrying several children at once. However, for riding alone or carrying solid loads the Larry vs Harry Bullitt™ (front-loader) is:

> a little sportier, I like the way it feels it's a unique feel …It's kind of a sporty geometry, almost like a mountain bike … a little bit smaller than other long johns and lighter, I can actually pick it up and carry it with one hand if need be (PO8).

According to PO9 the Bullitt™ widens the appeal of cargo bikes to people who would not necessarily consider cycling as attractive or effective for load-carrying:

> Larry vs Harry made a sexy cargo bike that the racing demographic can understand … it's exciting in terms of cargo bike proliferation it's like catching the eyes of people who weren't thinking within that paradigm.

PO7 also has three cargo cycles, again including front-loaders and a longtail. One of the metrics that PO7 uses to distinguish between cargo bikes is their ability to substitute for a car whilst maintaining the exercise component of cycling, with the decision to purchase a Bullitt™ being 'a reaction to bakfiets [heavier front-loader]

riding for 2.5 years' carrying his son to school. Adding E-assist to the bakfiets was 'magical' because it was:

> so heavy and an inefficient riding position … it transformed it into something that really could replace a car because of its speed and distance which was amazing, but it was basically not any exercise … went down and test drove a Bullitt™ with my son in the box and was a little taken aback by the initial peculiar handling [steering geometry] … three minutes later, after ascending a steep hill while riding out of the saddle, I knew I was done with the bakfiets.

PO9 says a 'well-built longtail is no slouch and for certain tours of duty should be taken seriously'. Both PO7 and PO8's households have longtails within their fleets of cargo bikes. PO7 initially bought his household's longtail for peer-to-peer rental but his partner:

> fell in love with the bike and prefers it to a normal bike as it's easy to handle and sure-footed even for longer trips … she likes carrying our son on it … doesn't have a big background in bicycling … watched friends testing front-loaders for 2.5 years, but the longtail has the ability for people to conceptually get their minds around and place themselves upon it before they get on it.

The freight functionality and flexibility is also important to PO8's wife, who also tends to use a longtail, but having both a front-loader and a longtail increases overall household flexibility, maximising the utility of cargo-cycling relative to need. In Christchurch in traffic, CH8 feels 'bigger and more staunch' on her longtail - drivers ask 'what are you a tandem, what are you?' Conversely CH11 feels like the 'longtails are not as good for chatting to each other … but it would be good to not be so cumbersome [as the front-loader trike]'.

Finding the right setup of load-carrying panniers is important for longtail riders CH8 and CH5 in Christchurch, to maintain a balance between freight function and flexibility, as longtails do not usually have the sort of easily loadable box arrangement found on front-loaders. CH5 has done a lot of 'messing around' with different setups for cargo. The bags that came with the bike 'were not waterproof and heavy and soggy when wet – the rubber coating wasn't waterproof. A 50-60 litre tub on the back was good for shopping but made the bike top heavy. For CH8:

> It comes back to it's tidy, I like the unit, it's tidy, I'm not having to use bits of string to tie on this to make this go … I just want to get on and it's simple. I don't want to look like too much of a freak you know.

The rhythmic components of flexibility operate at more than one level, with the rhythms of practices being related to externally enforced rhythm constraints such as the seasonal and episodic rhythms of weather events such as rainfall, wind, and snow. According to PO7, in a place as rainy as Portland, for families that have the means and with young children the ability of a front-loader to enclose children to protect them from the weather overcomes the:

> objection and fears people have. For a lot of parents no rain cover for the kids would be a deal breaker so the offering of front loaders for niche fears and niche understandings and particular families with enough kids to overwhelm a longtail they offer a capability to allow people to mentally and practically use a cargo bike when they would refuse with an exposed longtail.

As a 'hard core cyclist' in Christchurch, CH4 rides his homebuilt front-loader more than his wife, as he is 'more dedicated to riding in any weather'. He admits that transporting a young child takes 'a bit more planning than [using a] car, weather extremes requiring him to use the rain cover or sun shade he has made to cover his child in the box. Also in Christchurch, CH11 exhibits the concerns, and invokes the solution suggested by PO7:

> It's about keeping baby dry … that's what's really good about the … [front-loader trike] we really like … the cover … it's seems like he'd be comfortable in there, it's really easy to use, it seems like a good system. You can chuck lots of things in to the box in a way that wouldn't work with panniers. In bad weather, if he's well covered … I'm not averse to putting on my …wet weathers.

For CH6 and CH7 lack of a rain cover for their front-loader, reduces its flexibility, with use becoming weather dependent.

A further component of flexibility, identified by Powells et al. (2014), relates to the flexibility of working with and around the rhythms and capabilities of practices. Cargo bikes are argued to be 'as fast as car around town' (CH3), although according to CH8 parking the longer pedal cycles can be 'a bit more awkward' than a conventional bicycle. Design, utility, and ease of use are another manifestation of flexibility, which attracts a lot of commentary from participants. CH4 for instance likes his front-loader because it's 'like riding a normal bike', allowing him to cut down between traffic, with everything on the bike being narrower than the handlebars; 'it feels safer when mixing it with traffic to know where your boundaries are in front of you rather than pulling stuff behind'. By contrast CH6 and CH7's heavier and bulkier front-loader is less easy to ride than a conventional bike, and unlike PO7's Bullitt™, it has a big turning circle, and 'you can't stand up and pedal'. Thus,

although this bike offers a freight function for carrying goods, children and shopping, its design constrains its use to specific purposes, presenting CH6 and CH7 with an alternative to using a car, but not the flexibility in use and enjoyment experienced by CH4, PO8, and PO7.

For CH3 E-assist both increases the freight function of a cargo bike, facilitating the carriage of big loads, and also gave his partner the flexibility she needed to cycle for more of her pregnancy. According to CH8, 'it's the type of bike, it's the carrying capacity that … [women are] interested in' which can be enhanced by E-assist. CH11 and her partner have talked about adding E-assist later as 'it might make the difference to use the bike every time'.

## 9.4 **Synthesis and implications – cargo-capable cycling as transmodality**

A geography of transitions in practice must, it is argued be able to accommodate and follow the dynamics of 'differently evolving … but sometimes overlapping, practices' (Shove et al., 2013: 11). Such accommodation of overlaps is broadly consistent with consideration of the transmodality of regarding driving as a form of cycling (Shove, n.d.), or cycling a form of driving, where transmodality is understood as a sharing of affinities, characteristics, and affordances (Mom, 2011) of mobility practices. At a simple level, transmodality can be observed in "borrowing" a shopping trolley as a mechanism to transport the shopping home (Clifton, 2004: 410), taking the instore trolley beyond its intended use. Home-built cargo bikes can even be observed to embrace that transmodality in hybrid forms (Figure 9-4), which in some cases repurpose and incorporate shopping trolleys within their design, to achieve freight functionality. Shopping trolleys and cargo cycles could thus be argued in a very literal sense, to be part of a continuum of load-carrying non-motorised and motorised modes of categorically *indistinct* technologies and possibilities, as elaborated upon in Cox and van de Walle's (2007) relational model of modes (Figure 9-3).

This rethinking of mobility based upon personal transport as a continuum of interlinked types and technologies represents a broadening of the conditions of tranportation possibility (Cox & van de Walle, 2007; Nettleton & Green, 2014). It challenges assumptions of car dependency, associated with the car dependent practices identified by Anable et al. (2014), which reinforce historical positioning of pedal cycle and car designs as segregated entities, missing 'important linkages and commonalities between transport technologies' (Cox & van de Walle, 2007: 117).


**Figure 9-4 Shopping trolley cargo bike**
(source: http://www.bikehacks.com/bikehacks/2011/11/shopping-cart-cargo-bike-hack.html)

Transmodality's focus on shared affinities, characteristics, and affordances supports a way of accounting for mobility which emphasises shades and nuances of difference and commonality in transport types and technologies, rather than categorical distinction. This positioning reflects a continuum of need for mobility based upon the rhythms of mobility-related practices, reflected in participant commentary on both cargo-cycling as a substitute for driving, and the nuances of function and versatility/flexibility described in relation to different cargo bike designs and models, with specific suites of practices shaping demand.

Thinking in terms of the continuum of cargo-capability of pedal cycles, and their comparison to cars thus raises questions of bifurcation and hybridity of freight function, which both broadens and breaks down boundaries in terms of both pedal cycle functionality, and categorical distinction. This blurring of boundaries is seen in characterisations of cargo bikes as vehicles which possess attributes more usually associated with SUVs or minivans on the one hand, and the visual similarity of one form of cargo-capable pedal cycle, the E-assist enclosed trike as exemplified by the Elf™ on the other. Bifurcation retains branches as recognisable elements of a practice entity but one where the branches support more specialised performances as practice-variants or sub-practices (Røpke, 2009; Watson, 2012), with disparate material elements allowing significant variation (Figure 9-4). Thus, while cargo-cycling is clearly a form or recognisable sub-set of cycling, it, like many other practice-variants draws and holds people to the practice of cycling because of its specific attributes. Expressed as fluid, challenging 'necessarily topological'

relationships, hybridity, therefore, emphasises multiplicity generated by the 'movements and rhythms of heterogeneous association' (Whatmore, 2002: 6). The fluid relationships of hybridity and bifurcation (Figure 9-4), are manifested in the sharing of elements of cargo-capability between cargo-cycling and driving (green and blue respectively in Figure 9-5). In this way, the Elf™, like the Bullitt™ are seen to offer an opportunity to overcome car-dependence whilst still offering a functionality to accomplish the freight-function of mobility. Marketing seeks to expose and exploit aspects of that transmodality by emphasising cross-overs such as the styling of the Elf™ as an 'eco-friendly bike-car' (organictransit.com), and the Bullitt™ as:

> a viable alternative to the car … Workmen use Bullitts to carry their tools; delivery and messenger companies use Bullitts instead of minivans, people commute on them, do their shopping, pick up their kids … You name it (http://larryvsharry.com/about-larry-vs-harry/).

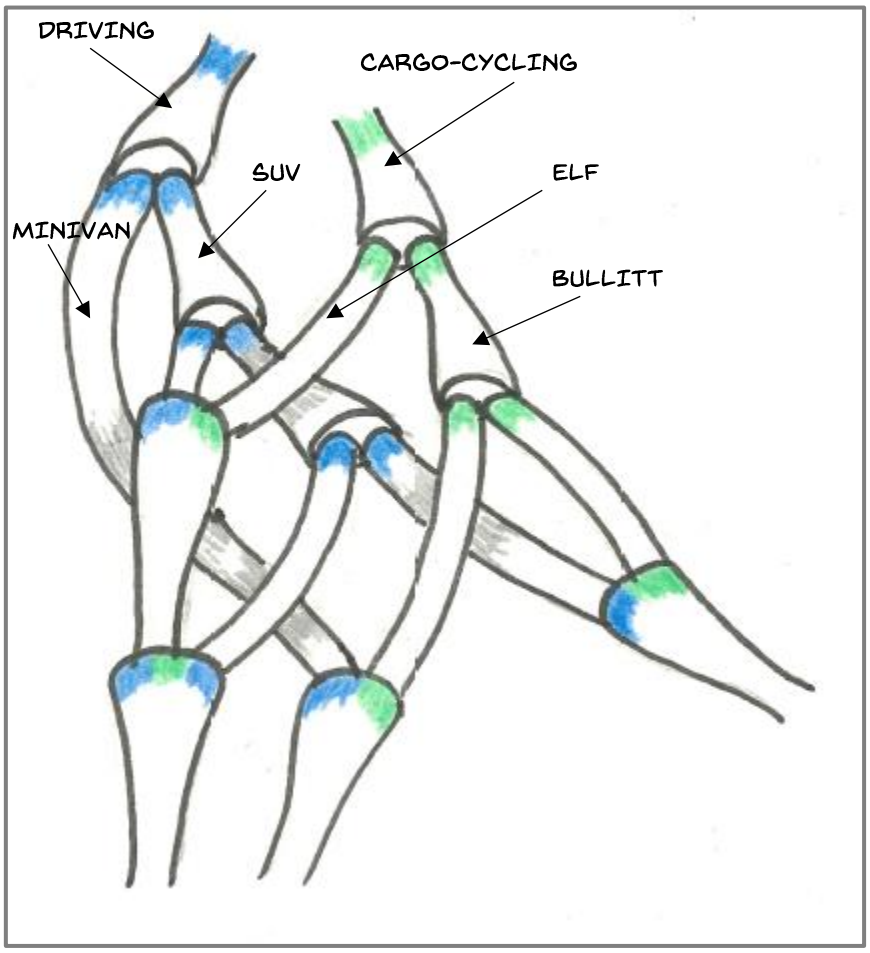


**Figure 9-5 Hybridity and bifurcation of cargo-cycling and driving exemplars, adapted from Beck** (source: Garland (1994))

Countering and complementing the subdivision of bifurcation, hybridity emphasises the combining of disparate elements within a recognisable but variable style or form.

Hybridity has a number of aspects. It folds concepts of human and non-human as distributed dynamic doing, in a process of co-evolution (Watson & Shove, 2008), and sees new material and practice combinations come into use, with capabilities greater than the sum of their parts (Watson & Shove, 2008). Like McHardy's study of E-biking, cargo-cycling and driving are mode-person hybrids, which accentuate cargo capability and blur the boundaries between humans and non-humans (Cox, 2012). Cargo bikes express another form of hybridity which internalises the capabilities associated with appendages that can be attached to a conventional bicycle such as panniers, trailers, racks and child seats, in the form of a "boot". Like the SUVs, station wagons and minivans of the car world that cargo bikes are routinely compared to, this internalisation provides additional capability for day-to-day co-ordination, flexibility, and freight function, facilitating the movement of goods, equipment, and people, in a challenge to car dependence. Thus, while the longtail has significant appeal to existing cyclists, innovation is evident in cargo bike design such as the Larry vs Harry Bullitt™, identified by PO9 as widening the appeal of cargo bikes to people who would not have considered cycling as an option for load-carrying:

> catching the eyes of people who weren't thinking within that paradigm … it reminds me of Clever Cycles [Portland urban focused bicycle retailer]. They related to professional urban people who weren't sure how to integrate bicycle transportation into their lifestyle … it's really important that they appeal to this big wedge of the population who weren't feeling OK about joining in.

The Bullitt™ as a "high performance" cargo bike is identified by PO9 and PO8 as sharing perceptions with high performance cars of being "sporty" and "sexy", marketed as a 'desirable object' on which the rider will 'look good' (http://www.larryvsharry.com/about-larry-vs-harry/). Equally, while ultra-small cars are not new – think for instance about the so-called bubble car, the Reliant Robin™ and the Fiat™ range – their recent incarnation in vehicles such as the smart™ car emphasise an agile urban chic, capable of meeting local transportation needs with economy and flexibility. All these intersections are expressed in Figure 9-4's stylised representation of hybridity/bifurcation relationships where pure form is replaced by a transmodal continuum which is perpetually subjected refinement and innovation, placing pockets of persistence in productive tension with niches of innovation (Shove, 2012).

Cargo bikes are argued to be 'as fast as car around town' (CH3), substituting for a car whilst maintaining the exercise component of cycling, countering discourses of cycling depicting an old and marginal technology. Like motorised vehicles, alternative cycle designs may be wider, longer, faster, more or less manoeuvrable, and easier or harder to start and stop. All these factors impact the performance of cycling in a built environment, which when seeking to cater for the needs of cycling, is often designed on the basis of a 'normal' diamond-framed 'safety' cycle. Not accounting for transmodality and hybridity has consequences for infrastructural design, with potential for a 'growing danger of obsolescence in existing segregated infrastructure' (Cox, 2012: 7), if that infrastructure does not accommodate mobility based upon the operational characteristics of the transmodality of bifurcated and hybridising pedal cycle and car designs. Equally, a lack of infrastructural development may act as a disincentive to design innovation.

The proliferation of particular points of relationship between transmodal hybrids and bifurcations can be understood as a congealing of load-carrying practices in accordance with the flexibility of temporal rhythms where routines of load-carrying are practically brought together, but not necessarily permanently stuck together, in space and time (Nicholls & Strengers, 2015). Such relationship may be constrained by the operational characteristics of the built environment and its ability to accommodate the operational characteristics of bifurcated designs. Ultimately the expression of flexibility in the freight function of modes understood as a transmodality reflects the nuanced relationship expressed by research participants, where mode is a reflection of need for mobility which is not fixed in space or time.

Focussing on freight function has emphasised a transmodality, where cycling and driving can be regarded as practice-variants of load-carrying, with the transmodality apparent in cargo-capable cycling, and in the marketing of its affordances, emphasising shared affinities, characteristics and affordances (Mom, 2011), challenging dualistic assumptions of the inflexibility of routines (Trentmann, 2009) and categorical distinctions between technologies and their integration. Transmodality, I argue can be thought of as a productive tension between hybridity and bifurcation which challenges car dependency based upon freight function and flexibility. Interventions which challenge normalised standards of load-carrying can be aimed at the potential flexibility of practices of load-carrying mobility. However,

changes can only be achieved if people have access to sufficient means to accomplish load-carrying in alternative ways.

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## 9.5 **Practice summary**

The visual representation of the practice dynamics zoomed in upon in Chapter 9 (Figure 9-6) is deceptively simple, incorporating both hybridity and bifurcation to reflect transmodality. Cargo-capable cycling and driving practices are observed to bifurcate into specialist functions and discourses, but at the same time the boundaries between the two become shared and potentially less distinct or porous. Properties of elements such as the ”boot” of the cargo cycle and car are identified as being shared, with consequences for the sharing of competence and image, which demand cargo capability, based upon a continuum of categorically indistinct technologies and possibilities.

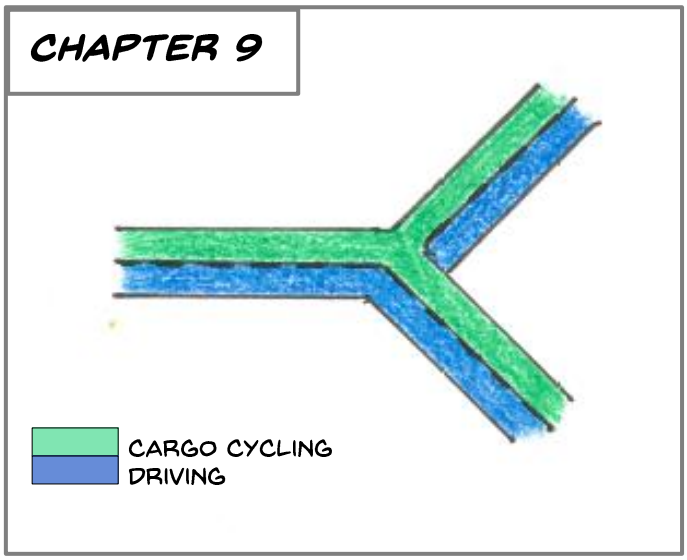


**Figure 9-6 Chapter 9 practice summary**

# Part C – Accounting for cargo-cycling in decarbonised urban mobility

This thesis is a response to the research question **what contribution can cargo bikes make to decarbonised urban mobility?** It investigates cargo-cycling and its relationships to other practices from an approach informed by SPT. To answer this question a zooming process was used to gradually fill-in, chapter by chapter, parts of the picture formulating the contribution this thesis makes to knowledge of load-carrying practices as manifested in cargo-cycling. This final section draws together the insights from the preceding chapters to answer the constituent elements of the research question posed in Chapter 1 concerning the contribution cargo bikes can make to decarbonised urban mobility and the implications of using a SPT guided approach. This task is accomplished in two chapters.

Chapter 10 coalesces the findings from the preceding empirical and theoretical chapters based upon four main themes derived from the investigation. The written analysis is complemented by the bringing together of the topological diagrams used to summarise each empirical chapter in a final zooming-out to the linkages between those diagrams in a new form of visual interpretation of practice relationships.

To conclude this thesis, Chapter 11 summarises the contribution this thesis makes to knowledge of the decarbonisation of load-carrying practices as achieved through the incorporation of cargo-cycling. This conclusion shows how the aims of this research have been achieved by answering the core research question and meeting the research objectives. The contribution made by this thesis to knowledge of the integration of cargo bikes into urban load-carrying practices to support decarbonisation of mobility practices is summarised. Acknowledging some limitations of the research, the conclusion points to further work that can be undertaken to increase the impact and practical value of this research.

# Chapter 10 Research Findings – theoretical, empirical and methodological responses

## 10.1 Introduction

In December 2015, the *Paris Agreement* of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) was signed. This non-binding Agreement reflects the aim of the 195 participating countries to reduce carbon outputs 'as soon as possible', to try to keep the increase in global average temperature 'to well below 2°C above pre-industrial levels' (UNFCCC, 2015). A major problem in actioning this non-binding agreement is the embedding of high-carbon consumption in contemporary Western lifestyles (Karvonen, 2013; Sayer, 2013). Recent years have seen considerable discussion concerning the sustainability of cities, and transportation's role in reducing greenhouse gases and carbon dioxide emissions. In the transport sphere, progress 'appears intractably difficult … as the private car … remains the mainstream mode of use and choice' (Hickman & Banister, 2014: xix) limiting progress in delivering decarbonised mobility. Hickman and Banister identify a lack of enabling of decarbonised future transportation patterns, with few indications that the general public 'can adapt to and adopt low carbon travel' (p. xix), with aspirations to own and use a car increasing globally. Indeed a Radio New Zealand programme from 12 June 2016, addressing whether change in transport technologies could help to avert catastrophic climate change, points to such tensions (Frykberg, 2016). This programme, questions whether using technology such as electric and driverless cars and trucks, to support existing behaviours is the only practical way forward, or whether this sort of single-solution thinking can alone meet the need to decarbonise transport. Achieving more sustainable lifestyles is likely to necessitate major changes in everyday practices, and 'considerable political will' (Sayer, 2013: 167). This research takes inspiration from the increasing number of researchers who, like Cox and van de Walle (2007), seek to challenge the positioning of automobiles as the ultimate form of personal transport, and to rescue 'non-automobiles' from narratives of marginalisation, positioning them as viable, appropriate, and sustainable modes.

In taking up this challenge, this research embraces what Lyons (2012) describes as the re-positioning of the social sciences, from "back-end" fixes to problems of scientific development, to a concern with 'the broader system of society and social

practices' (p. 30). Research across a number of disciplines has contributed to the identification of positive 'emerging practice', in terms of urban planning, public transportation, walking, and most significantly for this thesis, cycling, in predominantly European, South American, and Asian cities (Hickman & Banister, 2014). However, globally, governments have shown little political will in addressing the changes required, with conventional understandings of policy formulation tending towards "either or prescriptions", which concentrate on technological fixes or voluntaristic behaviour change, based upon overcoming barriers to making "better" choices. Such understanding are predicated upon neo-liberal individual 'responsibilitisation' (Sayer, 2013; Walker, 2014a) of problems, solutions, and change (McMeekin & Southerton, 2012), with technical fixes reinforcing the stability of the status quo and the political economy based upon capital accumulation (Sayer, 2013), and behaviour change initiatives seeking to inspire adaptive change (Lyons, 2012). Reviews of international behavioural change initiatives conclude, that isolated mechanisms focused on individual attitudes and actions may be sub-optimal (Evans et al., 2012; Southerton, McMeekin, & Evans, 2011). This research has engaged with the tensions between stability and change, by adopting a practice theoretical perspective, which seeks to move beyond (Shove, 2010a; Strengers & Maller, 2014; Strengers et al., 2014; Walker, 2014a) solutions based upon technical fixes and behavioural change initiatives, and beyond the marginalisation of cycling as a load-carrying practice. Analysis of the 46 interviews and the QM study conducted for this research, suggests that using practice as the basis for interrogating problems allows reconceptualization of problem representations, offering important insights into cycling as a day-to-day practice which affords load-carrying in the domestic, as well as the commercial sphere.

Decentring technological fixes and the individual as a choice-making consumer (Walker, 2014a), does not render the individual invisible, but rather turns attention to what people do - the multiple practices people engage in. By making practices the central unit of analysis, people become located at the crossing points of those practices (Reckwitz, 2002; Walker, 2014a). In making use of the analytical simplification of SPT (Shove et al., 2012; Shove & Spurling, 2013), this research has highlighted the active integration of three elements, materials or stuff; competence, skills or know-how; and meanings or images in practices; and the co-ordination of practices in daily life, to build upon and offer new insights into how decarbonised load-carrying is, and can be, achieved.

With a particular focus on two cities, Christchurch, and Portland - cities with high levels of cycling participation for their respective countries, but low cycling rates by best practice standards – this research examines **the contribution cargo bikes can make to Western decarbonised urban mobility**. My focus is on both the use of cargo bikes as a cargo-capable mode and the implications of SPT as the theoretical perspective underpinning this research into urban load-carrying mobility.

The findings from the preceding chapters point to the importance of load-carrying as an activity which cross-cuts a number of practices, problematising an assumption that load-carrying is a non-negotiable need that can only be met by driving. Despite an emphasis in the literature on building facilities to incentivise cycling, which is undoubtedly part of the solution to increasing cycling rates, evidence suggests that infrastructure will not guarantee the recruitment of more people to cycling, although it is likely to increase the possibility of cycling for those concerned about cycling in traffic (Jones, 2008). This research was partly inspired by a nagging feeling when reviewing recent scholarship on cycling, that a concentration on behaviour change and/or infrastructural issues, might be missing something. Some studies make passing mention of the difficulties of carrying loads while cycling (see for instance Heinen et al., 2010; Mullan, 2012; Taylor et al., 2009), and limitations placed particularly upon women's cycling activities due to women continuing to hold a disproportionate responsibility for household provisioning and childcare (Dickinson et al., 2003; Godefrooij et al., 2009). However, little scholarship has specifically addressed load-carrying by pedal cycle, and where it has, the chief focus, as shown in Chapter 2, has been the commercial realm. Carrying loads is the core function of cargo bikes, and the movement of loads is a key component in a number of everyday practices. The conjoining of looking at the problem from a different angle, and my search for a theoretical perspective that allowed me to ask different questions, has culminated in a series of findings concerning the utility of cargo-cycling as a load-carrying activity, which collectively meet my objectives:

a. To examine how load-carrying is achieved by pedal cycle.
b. To identify how cargo bikes are incorporated into everyday activities and their potential contribution to more sustainable patterns of mobility.
c. To critically assess the application of an SPT framework to research on cargo-cycling.

The core findings from the empirical research are presented in the next section within the context of the theoretical and investigative scholarship introduced in Chapter 1 and reviewed in Part B. In subsequent sections, specific findings related to each research objective are put forward.

## 10.2 What contribution can cargo bikes make to decarbonised urban mobility?

This research sets out to understand the ways in which cargo bikes can be incorporated into everyday practices to facilitate and support change towards lower carbon mobility. The key finding is that **cargo bikes open up new, and widen existing possibilities for organising and co-ordinating activities which require load-carrying in everyday life**. The participants in this research are primarily people going about their normal daily lives. Being contingent upon, and emergent from the integration of a number of activities, cycling and/or driving practices facilitate coordination of the interfaces between for instances home and work, and shopping, and transporting children to and from school (Pooley, Horton, et al., 2011; Watson, 2012). Introducing the specific material properties of cargo bikes into this mix, widens the meanings and competences of cycling, broadening the range and complexity of tasks that can be achieved without driving. The material properties of the cargo bike widen the possibilities of achieving load-carrying activities beyond those "normally" associated with a pedal cycle.

Two additional core findings flesh-out this initial finding. The first is that in widening the types of load-carrying practices that can be achieved by using a cargo bike and increasing the number of practices that can be combined within a trip, **cargo-cycling extends the proportion of trips that people who already cycle can achieve by pedal cycle**. This both **reduces driving, and restricts car use to a narrow range of practices,** such as out of town trips and holidays, and supports the justification of cargo bike investment, as **cargo bikes are conceptualised as an alternative to a second car**.

The second related finding, is that the utility embodied in a cargo bike, in terms of cargo versatility and capability, means that **cargo bikes reduce defection from cycling, of previously committed cyclists,** at "pressure points", such as when adapting to changing household logistical needs and pressures, resulting from the

birth of children, situations normalised as requiring driving for successful accomplishment of responsible parenting.

To further expand upon these key findings, I now turn to each of the research objectives to present a more nuanced explanation of cargo-cycling, and its relationship to other practices.

## 10.3 Accounting for recruitment and persistence

The first research objective seeks to explore load-carrying by pedal cycle, to ascertain how cargo bikes are used, and by whom. This study finds, through interviews and observation in Christchurch and Portland, that two main groups of people use cargo bikes on a regular basis. One group from the commercial realm operate their businesses from or via cargo bikes. Chapters 2 and 3 pay particular attention to scholarship on the use of cargo bikes for deliveries, mainly in a European and North American context. The second group - the focus of the majority of the empirical investigation in this thesis - are domestic users of cargo bikes. Retailers in Portland and New Zealand note, that households with children form the majority of their customers. These observations are consistent with data from the City of Copenhagen, which also situates cargo bike use as being significant in households with children.

### 10.3.1 Materials, know-how, and image

In considering which cargo-capable pedal cycles could most effectively meet load-carrying needs, Chapter 5 makes it clear that the contextualisation of pedal cycles as material objects is based upon their relationships with other material elements such as infrastructural characteristics, the 'stuff' to be carried, the regularity of load-carrying, the activities to be combined with load-carrying, and topographical and climatic conditions. The perceived competence embodied in pedal cycle handling characteristics and the meanings suggested by pedal cycle configurations and styles such as 'stable' or 'freaky' are also important. For practitioners already recruited to the practice of load-carrying cycling, in practice terms, this study suggests the temporal and spatial context of need is important in selecting a pedal cycle, with cost and familiarity with technology further considerations highlighted in the QM study, and in interviews with early adopters of cargo bike use in Portland and Christchurch. While the QM study reveals four main types of load-carrying, only one style of cargo-capable pedal cycle was consistently regarded as viable across all four factors, this being the longtail. Anecdotal evidence from Portland also suggests that the longtail,

as a design emanating from North America (and the UK), has significant market share in Portland. In New Zealand, despite longtails being the focus of early 'trial' imports, the few conspicuous retailers of cargo bikes appear more focused on front-loaders, in their current import and marketing strategies. In particular, the 'sporty' Larry vs Harry Bullitt™ is popular with cycle couriers and people with small families, or families with more than one cargo bike, suggesting that **material diversity, image, and competence acquired through experience are important factors in practice development and persistence**. However, evidence from Portland and Christchurch suggests that without previous experience of riding cargo bikes, **conceptually the longtail, with its conventional bicycle handling requirements, and ability to combine the carriage of children and other loads may be an entry point for people into cargo-cycling.** While some earlier models had perceived limitations in terms of weight, gearing and componentry, these limitations have been improved upon with newer models, and this factor, coupled with a lower price point than for quality front-loaders, has the potential to make these cargo bikes accessible to a wider demographic.

Chapter 6 shows that home-building may be a practical entry point to cargo-cycling. Competence, as an emergent attribute of relations between humans and non-humans (Shove et al., 2007), relates both to the competence of the home-building project, and the competence emergent from subsequent incorporation of home-built cargo bikes into load-carrying practices. There seems to be a connection between the construction and maintenance of the artefact, and the pleasure and utility gained from using it, with home-builders satisfaction with their pedal cycle being a material manifestation of the skill embodied in a home-building project. However, non-home-builders seem to be less attracted to the image of home-built pedal cycles, finding the product competence incorporated in images of commercially produced cargo bikes to be a more effective recruitment tool, than the potential cost savings of having a home-builder build a cargo-bike for them. The primary requirement for effective reliable load-carrying across a range activities is seen to be more likely to be achieved in a reliable, professionally finished, and relatively unobtrusive manner by a commercially produced product, which does not portray images of home-building. It should, however, be noted that the commercially produced cargo cycles popular with research participants are almost always the products of niche manufacturers, who have entered the marketplace to produce specialist solutions to load-carrying, rather than products of the significant players in the leisure focussed cycling industry.

There is an additional aspect to the meaning of cargo-cycling, which can be identified from the practitioners responses, in Portland and Christchurch: the meaning of community connection and personal well-being. In Chaper 8, at a community level, CH5 notes the negative impact of car driving, where carsons (car/persons) (Böhm et al, 2006) experience the world from inside a car, cut off from the sociality of the street. CH10 points to the sense of community engendered by people not being in cars and the positive communication that can occur across generations and between walkers and cyclists, with images of personal and community well-being forming an element of the performance of cargo cycling. In Chapter 7, this community level well-being is clearly an aspect of disaster preparedness, with the DRT seeking to stimulate proactive recruitment prior to a disaster event, which combines fun and celebration within the public domain, with routine daily practices of load-carrying, informed and influenced by global events. Showcasing and embedding inter-locking suites of practices in the present, not only increases daily well-being and sustainability, but also long-term resilience, with opportunities for 'human scale connectivity' (PO7). This human scale of connectivity, expressed as well-being, is also noted as a feature of the cargo bike-focussed social enterprises discussed in section 2.6.4, where services which benefit the community, are argued to blend social and environmental responsibility with 'cycle powered service provision' (CycleLogistics, 2013: 12-13), which responds to identified community needs for social contact, transport, and employment (Elster, 2003).

On a more personal level, health and well-being are understood to benefit from the integration of the cargo cycling into daily lives, rather than deliberately exercising as a leisure pursuit. For women participants in Christchurch, a strong association is made between maintaining cycling and personal well-being, where cargo-cycling may be the only route to meeting that need with young children, as you 'can't go anywhere without the kids' (CH7). Time poverty is strongly associated with childcare responsibilities and being in employment, and can also generate feelings of isolation and reduced well-being (Currie & Delbosc, 2010). Becoming car-reliant, and not being able to cycle when it is your normal mode, and the mode of choice of most of your friends, is also socially isolating and undermining of well-being. Conversely, cargo-cycling can be understood to make time for well-being (Shove et al., 2012). The increasing availability and recognition of cargo-cycling as a conduit for practice bundling, and as a means of enhancing well-being has the potential to unlock some

practices from their close relationship with driving, and to overcome the '*inverse* relationship between car-ownership and social well-being' noted by Jones (1987: 36) when first articulating the forced car ownership concept.

### 10.3.2 Presence

In practice theory, emergence of new practices has received attention, but less work has been done on practice trajectories and migration (Maller & Strengers, 2013), and what happens to practices in new locations (Everts et al., 2011). While contemporary cargo biking has been developing in Portland over the last decade, cargo biking in Christchurch is a more recently emergent practice-variant of cycling and load-carrying. SPT suggests that rather than practices travelling wholesale in timespace (Schatzki, 2009), it is the elements of practice which travel and are reconfigured to meet local needs and conditions, a process of constant moving and transforming (Maller & Strengers, 2013; Pantzar & Shove, 2010a; Shove & Pantzar, 2007; Warde, 2005). As carriers of practice, practitioners are part of that transfer. This is seen in the partial attribution of contemporary cargo-cycling in Portland to European influenced bike shop owners and a temporary resident of the city who brought her front-loading cargo bike with her from Europe (PO1; PO2; PO9). Both these innovators served to increase the presence of the material technology, the know-how of using cargo bikes, and the image of cargo-cycling as a mechanism of meeting load-carrying need within the city. While the growth in cargo-cycling in Portland needs to be seen in the context of the overall growth of cycling in the city, in Christchurch the conditions of possibility are different, with stable cycling rates and a city rebuilding infrastructure following the 2011 earthquake events. Many of the participants from Christchurch cannot pinpoint how they first came to know about cargo bikes and the 'possibilities' (Shove & Pantzar, 2007) they afford, but none of the early adopters cite seeing a cargo bike in Christchurch as a catalyst. As existing cyclists, they had access to and awareness of diverse images of cycling from other cities and countries, through personal contacts, and media and advertising representations. With a combination of interest, competence, and appreciation of pedal cycles as a mode of transport, and often a source of well-being in their lives (section 8.4.2), these people, in practice terms deliberately assimilate a new materiality into their cycling practice, adapted to local conditions (Maller & Strengers, 2013; Pantzar & Shove, 2010b). As investigated in Chapter 6, **home-building overcomes a lack of availability or affordability of commercially available alternatives and extends capacity to meet load-carrying needs**, often at a point in people's lives where the rhythms of

load-carrying change, due to increasing household size or work commitments. Such adaptations and incorporations, reinforce the inappropriateness of 'the metaphor of wholesale transplantation' of practices, and the importance of 'the characteristics of the existing soil … [and] the deliberate work of cultivation' (Pristed Nielsen & Møller, 2014; Shove & Pantzar, 2007: 163).

These observations lead me to suggest that **presence is important in growing a practice beyond the lead-users, to the 'cargo curious' and further to a normalised means of load-carrying.** Awareness of specific elements of cycling hardware and components, and the skills, competence, and norms associated with their use are prerequisites for them being incorporated in daily mobility practices. While not all practices can or need to be practiced everywhere, within the 'uneven landscapes of possibility' (Shove et al., 2012: 132), each of the empirical chapters show that for a practice to develop, not only do the materials, competences, and images have to be present, but those elements have to be visibly linked in performance by early adopters, each performance changing the conditions of possibility for future integrations (Shove et al., 2007). A number of participants reference their roles as visible "ambassadors" for cargo-cycling, as one participant remarks 'you can't be an introvert on a cargo bike' (CH20). Homebuilding, for instance, contributes to the visibility of cargo-cycling as a load-carrying practice, by facilitating the lower-cost achievement of activities normalised as requiring driving, becoming one practice within a constellation of activities that potentially reinforce the visibility and viability of achieving load-carrying activities by pedal cycle. These exemplary practitioners (Birtchnell, 2012) showcase alternative practices in public, including at events like the DRT (Chapter 7) - a deliberate attempt to scale cargo-cycling in Portland - to generate and build upon 'excitement about what [cargo bike] … uses can be' (PO8), in the collective trajectories of suites of practices.

However, the vast majority of the participants in this study were already to some degree active cyclists, who deliberately carried at least small loads by pedal cycle. Thus, evidence from this study suggests that **cargo-cycling is largely recruiting from a pre-existing pool of cyclists, rather than recruiting new people to cycling**. This finding does little to support a trajectory of decarbonisation of transportation. However, there are two important additional provisos to this finding. The first, further developed in Chapter 5 and section 8.5.4, is that **cargo bikes, by virtue of their load-carrying capacity, limit temporary defection from cycling,**

when changes in household rhythms and make-up require accommodation of new practice combinations and needs, such as those associated with young children. The second point, also further developed in Chapters 5 and 8, that **cargo-cycling is an effective mechanism for meeting the transportation needs of families with children,** means that **the avoidance of defection from cycling following childbirth, is particularly relevant for women as the principle bearers of household provisioning and child-care duties.**

### 10.3.3 Equity

The social, equity and environmental issues of climate change mitigation through transport decarbonisation require ongoing political, policy, and academic engagement (Bickerstaff et al., 2013). Traditionally, the economic and environmental impacts of transport have been given primacy over social and distributional effects, although considerable recent academic attention has been given to researching uneven access to mobility services. Extending analysis to issues of unequal access to consumption activities and resources, including affordability and gendered travel practices, helps to combat practice theory's lack of attention to issues of equity and social justice (Walker, 2013; 2014a).

Contemporary practices are influenced by past practices, and in turn influence future practice trajectories, local differences being rooted in histories of spatial planning and traffic policies, and the local image and culture of cycling (Oosterhuis, 2014). Relative practice dominance impacts access to, and distribution of practices, with implications for decarbonised sustainability and equity. As noted in Chapter 1, there are distinct demographic differences in cycling as a mode of transport, between countries and urban areas. Local comparisons with "successful" cycling cities lead to media speculation regarding women as an' indicator species' for city bikeability (Baker, 2009; Underwood, 2009). Low cycling rates in Anglophone countries are compounded by a number of factors, including women making up as little as a quarter of commuter cyclists (Garrard et al., 2012). However, increases in cycling mode share do not necessarily correspond to increased representation of women, or older people in cycling statistics (Aldred et al., 2015), suggesting that deliberate targeting of under-represented groups may be required in both infrastructure and policy.

As a "successful" cycling city, Copenhagen can claim women as 60 percent of cyclists (Garrard et al., 2012), high levels of cargo bike ownership and use, and significant displacement of driving by cargo-cycling (section 1.4.2). While no causal relationship can be claimed, this phenomenon I argue, is worthy of attention, given both its sustainability and equity implications. The freight function of cargo bikes (sections 2.6.3 and 9.2.2), in overcoming some of the difficulties of carrying loads while cycling, makes them compatible with a range of family household dynamics and life stages (Jensen, 2013). While in this study, home-built cargo bikes are almost exclusively built, and predominantly ridden by men, observations by cargo bike retailers in Portland and New Zealand correlate with assertions made by Colville-Andersen in Denmark, that **women are instrumental in cargo bike purchase decisions**. The New Zealand interviews suggest (section 5.9 and Chapter 8), that for women the cargo capability of a pedal cycle is important in **avoiding their at least temporary defection from cycling after childbirth**, and for maintaining household cycling practices, which combine regular activities like shopping with activities with young children. For some parents, **the ability to transport the paraphernalia associated with caring for a young child, plus the ability to maintain a view of the child and to protect the child from weather extremes, are potential 'deal-breakers', which front-loaders are effective in overcoming**. For others, the longtail offers convenience and flexibility, coupled with conventional bike-handling properties.

Chapter 8, in zooming-out from accounts of situated cargo-cycling, investigates the social justice and equity implications of the relationship between cargo-cycling and car dependence, as manifested in the freight function of travel. Drawing on the transport disadvantage literature, and scholarship on forced car ownership, **cargo cycling is found to substitute for second car ownership**, with cost being clearly identified as restricting the possibilities of recruitment to cargo-cycling.

In essence, the data suggests, that **to be competitive with other modes, important considerations include the cost of cargo-cycling, coupled with the time, comfort, and enjoyment possibilities of meeting gender-based logistical convenience criteria** (Lovejoy & Handy, 2012). In places where owning more than one car has become close to a condition of participation, cargo bikes, once afforded, have the potential to significantly reduce the proportion of the weekly budget that has to be dedicated to mobility. In moving beyond identifying inequalities, to proposing solutions to societal participation (Mullen and Marsden, 2014),

understanding not only how people "do" practices in the present, but also how changing conditions of possibility might influence "doing" in the future, is crucial. In Portland, with increasing numbers of trips being accomplished by pedal cycle, there is evidence of a reduction in car ownership and use (Sivak, 2013), while for households with children, cargo-cycling seems to represent a foregoing of second car ownership rather than driving per se. A similar foregoing of second car ownership is observable in Christchurch, a subtle relationship between cycling and driving rather than simple competitive relations. Cargo-cycling affords the persistence of cycling as a localised load-carrying practice, but in most cases does not negotiate away driving as a means of achieving other, geographically more distant, often multi-person activities. As investigated in Chapter 8, understanding how cargo bikes can and do fit in to mobility practices, opens possibilities for intervention where cargo bikes can form part of a more equitable and sustainable transport system. Finding alternative ways of affording decarbonised mobility requires not only looking at how problems of affordability are framed but also seeking alternative solutions, which challenge existing conceptions of what it is to "do" mobility. For those currently experiencing lock-out from decarbonised, sustainable, and equitable mobility practices, solutions need to embody a capacity to "do" decarbonised mobility, which does not exacerbate existing inequalities, and perpetuate exclusion from the decarbonised mobility 'clubs' partly constituted by cargo-cycling.

As shown in Chapter 5, practice variation demands the availability of a range of cargo-capable bikes to meet need and competency requirements. The extra weight burden of shopping and transporting children, can make the provision of E-assist technology important for hilly terrain or cycling in strong winds, a provision which is also found to be significant for the participants in this study, in prolonging cycling practices into older age, and allowing women to continue cycling into late-stage pregnancy. As one participant notes, women tend to focus on the carrying capacity and versatility of a cargo bike, while men show interest in the technical details of the design (section 9.3), a point consistent with calls for policy and infrastructural targeting of under-represented groups.

Section 2.7.4 suggests that cycling projects have additional equity implications, with for instance cycle taxis and home delivery services having the potential to help overcome social exclusion, for users and providers, by improving people's confidence and skill sets and providing new services. Evaluation of projects shows a range of

social and economic benefits in addition to offering sustainable decarbonised community transport, with the potential to 'interest and engage a much wider audience than conventional approaches to cycling promotion centred on the benefits of cycling as a means of transport and for health and leisure' (Elster, 2003: 611). **Cargo-cycling can thus become a tool to address community needs, rather than increasing cycling levels being the sole policy focus**.

## 10.4 Accounting for integration and scaling

The second research objective focuses on how cargo-cycling is incorporated into everyday activities, in terms of its competition and coexistence with other practices. Analyses informed by practice theory challenge linear narratives, and the value of studying artefacts in isolation, instead calling for consideration of the *use* rather than invention of technology (Edgerton, 2007). The empirical and theoretical investigation conducted for this research shows that there are two core aspects to accounting for, integration and scaling. Coexistence focuses on the practices that cargo-cycling needs to synchronise with, in order to present a viable means of load-carrying to both maintain cycling and to recruit practitioners from other load-carrying practices. Competition relates to the other load-carrying practices with which cargo cycling competes for practitioners, primarily driving. The analysis that follows is, therefore, divided into issues of coexistence and competition.

### 10.4.1 Coexistence

A major strength of practice theory for this research is its focus on what people actually do, and how they combine those doings in daily life. The detail of local doings reflects a complex integration of elements, but to adequately account for changes in practice configurations, attention must be given to the scaling of practices in timespace. A practice-as-entity can be understood as a pattern, frame of reference, or resource for recognisable performances, but also as the sum total of performances to date. Either conceptualisation allows for practice variation, with change being understood to occur at the level of elements, practitioners, and the bundling together of practices (Watson, 2012). The previous section, in accounting for recruitment, dealt with issues of both variation in practice elements, and the consequences of bifurcation and hybridity for the population of cargo-cycling practitioners. In this section, I turn attention to the bundling of practices in timespace. The bundling of practices is not given or static, there being shifting interdependencies between practices over time and across space. These changes in rhythm and synchronicity have consequences for the life-course of practices, with

past and future trajectories carrying the 'seeds of constant change' (Warde, 2005: 140), in variation and innovation (Maller & Strengers, 2013). Consequently, the bundling of practices in the accomplishment of everyday life needs to be understood.

#### 10.4.1.1 Hybridity and bifurcation

Whilst the cargo bike form, as expressed in the longtail appears to be an acceptable cargo-capable solution for a number of participants in this study, a one size fits all approach to load-carrying does not seem realistic if cargo-cycling as a load-carrying practice is to grow. As revealed in Chapter 5 and investigated in Chapter 9, cargo-cycling expresses an interesting and productive tension between hybridity and bifurcation, with load-carrying being a facet of a number of practices, the combination of technologies combined within a particular design of pedal cycle, making it variously capable of meeting need for multiple forms of load-carrying.

Bifurcation expresses a branching recognisable as part of a practice entity, but one where the branching supports more specialised practice variants (Attfield, 2000; Røpke, 2009; Watson, 2012). Thus cargo-cycling, like other practice-variants draws and holds people to the practice of cycling because of its specific attributes (section 2.5). The changes in infrastructural provision noted by Pucher and colleagues (see for instance Buehler & Pucher, 2012; Pucher, Dill, et al., 2010), and behavioural change initiatives, are only as effective as the impact they have of changing practice and infrastructural constraints may actually limit the bifurcation potential of cycling technologies (Cox, 2012). Chapter 5 provided an exploratory window into the types and ordering of activities combined in mobility practices, **showing a bifurcation of need, and related practices based upon the combination of load-carrying activities to be achieved, pedal cycle-handling skills and safety competences, and previous exposure to sub-practices**. This bifurcation supports a perspective on practice entities that suggests 'there is no one practice' (McHardy, 2013: 140). **The bifurcation of cargo-capable designs supports the expansion of the range of achievable practice-variants, thereby extending the potential to promote recruitment to cargo-cycling,** although, as reflected upon in Chapter 8, **to grow cycling as a load-carrying practice, this recruitment needs to be based on defection from driving, rather than intra-practice poaching**.

In the process of hybridisation, new materials and practices start to come into use, and competence moves between humans and non-humans in a 'human-thing experience' (Jackson, 2006: 58), and between technologies. Like McHardy's study of

E-biking, I argue that cargo-cycling is a bike-person hybrid, which accentuates cargo-capability, brought together in a different form to a conventional bike. It is also a hybrid of specific competence, with material features different to a conventional bike to load and ride. As evidenced in Chapter 6, such hybridity may also include the competence to build hybrids of materials produced in large-scale industries with the small-scale and local (Edgerton, 2007). This can be understood as a distribution of competence across 'complexes of tools, materials, intermediaries and human beings', with competence emerging from such performative relations (Shove et al., 2007: 143): relations which include the sharing of skills between home-builders, so that the hybrids have capabilities in sum greater than the capabilities of the parts (Watson & Shove, 2008).

The incorporation of **E-assist technology is a further important element in avoiding defection from cycling** which has temporal and spatial components, and further blurs the boundaries between humans and non-humans (Cox, 2012). The analysis in Chapter 5 reveals a striking level of willingness to consider E-assist, either in the present or for the future. This willingness was notable in men and women, and across the age range of those interviewed. E-assist is variously considered useful in carrying heavy loads, including combined loads of children and goods; supporting cycling in hillier areas; coping with headwinds; supporting the uptake or continuation of cycling with advancing age; and increasing the range and number of cycle trips that can be achieved in a particular timeframe.

The issue of technical capabilities of E-assist technology is not one that can be dealt with in a uniform manner, with regulations varying between jurisdictions. Further, the quality, design, power output and battery stoarage capacity of E-assist pedal cycles shows considerable variation, with consequences for the human-thing relationship. In NZ, in accordance with section 168A(2) of the Land Transport Act 1998, the Power-assisted Cycles (Declaration Not to be Motor Vehicles) Notice 2013 declares:

> power-assisted cycles (as defined below) fitted with electric auxiliary propulsion motor(s) that have a combined maximum power output not exceeding 300W not to be motor vehicles.
> Cycle means:
> (a) a vehicle that has at least two wheels and that is designed primarily to be propelled by the muscular energy of the rider
> (https://gazette.govt.nz/notice/id/2013-au4618).

By constrast regulations in Oregon, and therefore, pertaining to Portland state:

" Electric assisted bicycle" means a vehicle that
(1) Is designed to be operated on the ground on wheels;
(2) Has a seat or saddle for use of the rider;
(3) Is designed to travel with no more than three wheels in contact with the ground;
(4) Has both fully operative pedals for human propulsion and an electric motor; and
(5) Is equipped with an electric motor that:
    (a) Has a power output of not more than 1,000 watts; and
    (b) Is incapable of propelling the vehicle at a speed of greater than 20 miles per hour on level ground (http://www.oregonlaws.org/glossary/definition/electric_assisted_bicycle).

This lack of consistency, particularly petaining to power output, goes some way to explaining some of the variation in views on E-assist cargo-cycling between Portland and Christchurch. For instance, PO7 claims that a front-loader with E-assist is 'not any exercise' in hilly Portland, while CH8, CH3, and CH22 assert the necessity of E-assist in making cargo bikes a workable load-carrying solution, when living in hillier locations in Christchurch, allowing cycling to occur more oftern for more trips. CH3, CH8, and CH22 all link E-assist to riding longtails, while PO7's commentary is based upon significantly higher E-assist power output, and the use of a heavier front-loader. PO7's commentary suggests that the regulations in Oregon are more supportive of achieving load-carrying practices using heavier larger cargo bikes.

However, simply relating the utility of E-assist to maximum legal power output underplays the complexity of applying E-assist technology. The regulation of power output is part of what McHardy (2013) describes as a process of normalising E-assisted cycling, by proscribe what counts as E-assist, and as a consequence which material configurations are excluded, embedding "allowed" new practices within systemic norms (Lewis, 2014). In NZ, the legal maximum of 300 watts output is estimated by one designer to facilitate, with no additional human power, speeds of 32-35km/hr (http://lekkie.bike/info/), very similar to the 20 mph Oregon limit. The majority of E-assist pedal cycles employ a hub driven motor, but an increasingly more common configuration, in Christchurch and Portland, is based upon a mid-drive system, which operates through the pedal cycle's gears. This system provides increased torque and speed range, explained in normative terms as the difference between automatic (hub) and manual (mid-drive) transmission systems in automobiles (http://lekkie.bike/info/). Coupled with improvement in battery technology, and the effect of tinkering as described in Chapter 6, to subvert legal restrictions, it becomes clear that the degree to which E-assist supports achievement

of co-existent load-carrying practices is nuanced and reflective of the translocation of elements of a practice, rather than the practice itself.

Some of the elements of cycle logistics associated with cargo-cycling, are shared with driving, giving rise to the suggestion interrogated in Chapter 9, that driving could be argued to be a form of cycling (Shove, n.d.), or cycling a form of driving based upon transmodal shared affinities, characteristics, and affordances (Mom, 2011). Essentially, the cargo-capable cycles discussed in Chapter 9 are a hybrid form in at least three ways: 1) as hybrids of conventional bicycles, which internalise the capabilities associated with appendages that can be attached to a conventional bicycle such as panniers, trailers, racks and child seats; 2) as a hybrid form that sits somewhere between a pedal cycle and car, in the same way that a small car can be made bigger, and carry additional load-types, by adding a trailer so too can a pedal cycle; and 3) as hybrids of humans and technology. Attaching a trailer to a car requires additional driving competence to successfully accomplish reversing and parking, and the affordance of a tow-bar. Likewise, pulling a trailer with a pedal cycle changes the skill-set required for cycling, and both practices require planning to ensure the trailer is maintained and available when required. Internalising that load-carrying capacity within the vehicle expressed in SUVs, station wagons and minivans of the car world (see Chapters 1, 2 and 9) and the cargo bikes they are routinely compared to, internalises that additional capability for coordinating the day-to-day, by facilitating the movement of goods, equipment, and people. However, for both technologies, the internalisation of those benefits, requires compromise such as in potentially higher purchase costs, and the reduced manoeuvrability inherent in that form of load-carrying. Equally, the hybridity expressed in Elf™ and smart™ car type vehicles, and the emerging technologies of electric and driverless cars, demand new or different competences, showing that as new materials and practices start to come into use, competence moves between humans and non-humans (Shove et al., 2007), blurring the boundaries between them (McHardy, 2013) (section 3.3).

#### 10.4.1.2 Rhythm and synchronicity – the arrangement of practices in timespace

Shove (2014a) suggests, that rather than promoting a particular type of vehicle or mode of transport, 'it might make better sense to identify and actively promote sets of practices' into which a decarbonised mobility might fit. A similar point is made by Clifton (2004), consistent with findings in section 10.3.3, suggesting 'approaches targeted to the "bundle" of needs in low-income communities' (p. 411) to be

potentially more effective than piecemeal policy approaches focused on mobility, with 'auto-oriented policies alone [not being] … a panacea for the mobility problems of the economically disadvantaged' (p. 411). This focus on sets or bundles of activities is one repeated by many participants in this research, with a means of achieving temporal and spatial coordination of activities being an important criterion for satisfying load-carrying need. For participants in New Zealand and Portland, 'pure load-carrying need' (PO9), of human and non-human cargo was the catalyst for the purchase or home-building of a cargo bike, in the commercial or the domestic realm.

Home-building is one response to the need to assimilate an additional activity into a suite of pre-existing mobility practices, a response to temporal change in household circumstances, which is one aspect of the temporality of practices and their inter-relationships. **Change in household rhythm, prompted by the birth of children, catalyse home-building projects and cargo bike purchase to facilitate the continued accomplishment of household travel and load-carrying activities by pedal cycle, rather than prompting increased driving.** Rhythmic repetition over daily, weekly, seasonal or episodic timescales (Walker, 2014b) can be observed in mobility practices, with the synchronous matching of rhythms of activity, at household, social/societal levels, and their intersection with natural rhythms being important for the congealing of practices. The collective temporal ordering of a household impacts the sequencing of individual practices (Pantzar & Shove, 2010a; Southerton, 2013; Walker, 2014b). Practitioners' accounts in Chapters 6 and 8 suggest that the birth of a child, the subsequent need to transport children, and the integration of such activities into practices, disrupts pre-existing mobility rhythms, and the synchronicity between those rhythms, with implications for mobility practices. Load-carrying has to be matched to the demands of an evolving set of interacting practices, the conjoining of activities requiring for these practitioners, the integration of an alternative material element in the load-carrying activity accomplished by cycling. Home-building projects, like the purchase of commercially produced cargo bikes, can thus be a mechanism to make sense of temporal flow and orchestrate and interweave complexes of practices, often generated by external life-course pressures.

In practice terms, flexibility can be thought of as a way of 'working with or around the rhythms, conventions, economies and capabilities of practices' (Powells et al., 2014: 44), the more rhythmically in tune suites of practices become, the more they

are coordinated and seen to operate in stable (Anable et al., 2014; Browne et al., 2012), but impermanent suites of practices (Nicholls & Strengers, 2015). Hence, a shift in one practice will affect the dynamics and coordination of the others within the suite, potentially disrupting synchronisation (Shove et al., 2009). Consequently, practices with greater capacity for synchronisation with multiple other practices will be advantaged in a competitive and dynamic process of practice recruitment, maintenance, and defection.

#### 10.4.1.3 Boundary objects and communities of practice

The notion of boundary objects conveys the spread of elements in practice theory, where their incorporation is nuanced in individual performances in timespace (Jensen, Wade, Pettersen, & Kuijer, 2014). Sustainability and resiliency motivated interventions and initiatives, inevitably involve multiple interactions between practice, with overlaps between the domestic and professional sectors. For example, the DRT (Chapter 7) both seeks to promote household use of cargo bikes and to influence government officials responsible for disaster preparedness. Likewise, design and marketing of cargo bikes (section 9.4) such as the Larry vs Harry Bullitt™, seeks to position these cargo bike as a desirable object in the commercial cycle courier/freight bike sector, as well as a 'sporty' addition to the domestic load-carrying realm. **The success of integrating the cargo bike into multiple everyday practices is important for the development of this practice-variant and for inter-practice recruitment and defection**. Cargo bikes can be thought of as a form of boundary object, an anchor or bridge (Star & Griesemer, 1989) people act with and toward (Nicolini, Mengis, & Swan, 2012), identifiable, but capable of adaption to different needs and practices, 'plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity' (Star & Griesemer, 1989: 393) across timespace.

Work on communities of practice also takes account of boundaries, the boundaries of practice communities being sites of competence and experience divergence (Wenger, 2000). Practices are constitutive of communities, bringing practitioners together in the sociality, but not necessarily co-presence of practice performance, the learning of know-how being emphasised (Everts et al., 2011). The cargo bike sits at the boundaries of communities of practice, such as the home-builders of cargo bikes in Christchurch discussed in Chapter 6, where the cargo bike is the point of unity and divergence between building and riding practices, and the point of unity between home-builders. The materiality of images, such as those circulated in cargo bike

builders websites, magazines, newspapers, and of course the images used as the resources for the sorting process in Chapter 5's application of QM, form the mechanisms for recruitment to communities of practice. They form the boundary between the researcher and the researched, as well as the boundary between the cargo bike designers and manufacturers, and the cyclists. The individual practitioners of homebuilding become resources within their community of interest, both in terms of know-how, but also as a means of accessing resources such as TIG welders. As early adopters they also have the potential to impact technical evolution, and perhaps even local market development (Hyysalo et al., 2013) by "glocalizing" (Oldenziel & de la Bruhèze, 2012) cargo bikes, challenging existing mobility practices, and potentially generating new practice configurations and performances (Walker, 2014b). In Christchurch, that innovation may be understood as part of a glocalizing to local post-earthquake road and resource conditions, as advocated by the DRT in Portland. Further, as manifest in Christchurch, user innovation is often characterised by sharing and reciprocity, and contribution to a common community of practice (Pantzar & Shove, 2010b). While the home-built cargo bikes in Christchurch would be recognisable as cargo bikes, if for instance transported to Copenhagen, the specifics of design, materials and know-how, and ultimate use, reflect the glocalization of local conditions.

### 10.4.2 Competition

In reflecting on relationships between cycling and driving, there is a tendency to de-centre the pedal cycle in the course of advocating the growth of cycling within the broader population, rather than promoting conditions which value a cycling culture without seeking to engender mass participation (Bonham, 2011). The practice perspective adopted in this thesis inevitably focuses on the relationship between practices of driving and cycling, the research question being framed against the backdrop of climate change, and the necessity of decarbonising mobility practices. In analysing the potential role of cargo bikes in such a change, this research has sought to identify what it is that attracts people to cargo-cycling as a manifestation of cycling practice (Watson, 2012): what it is about this technology, that when incorporated within a suite of load-carrying practices makes it more viable than a conventional bicycle. Given that in New Zealand most households have access to a pedal cycle, but many of those pedal cycles get little or no use, and at the same time car ownership and use is very high by international standards, this thesis asserts the validity of questioning how cycling can be advanced relative to driving, and

questions whether cargo-cycling can generate possible points of contact through which new practitioners can be recruited. From a practice perspective, recruitment is crucial to practice persistence and given scholarship which generally presents cycling as a societal good, recruitment is a valid aim. Most cyclists in the case studies are also drivers, and **recruitment to cargo-cycling from within the cohort of already committed cyclists is shown in this research, to allow those people to substitute cargo-cycling for driving on a more consistent basis than with use of a conventional bicycle**. This seems to be particularly true for people with families who need to transport children as well as engaging in other load-carrying activities, such as shopping.

A sustainable transport system is not just a decarbonised transport system. It is also one that is affordable so that people can meet their basic needs, and participate in the social, economic and political activities normalised for their community, in a manner consistent with intra- and inter-generational human and ecosystem health (Godefrooij et al., 2009; Kenyon et al., 2002). By this definition, a sustainable transport system is socially inclusive. Highly mobile societies, assuming normative automobile use, offer dispersed, spatially distant services (Cox, 2010a), but the mobility, spatial and temporal elements of social exclusion are frequently ignored in the literature (Cass et al., 2005: 539). The normative assumption of automobile use has, in the US resulted in neo-liberal welfare-to-work schemes offering loans to purchase cars as a supposed enhancement to mobility (Cox, 2010a), ignoring the unaffordability for many of the ongoing costs of ownership. Instead, Cass et al stress social inclusion as financial, physical, organisational and temporal 'access'.

The automobile has become a symbol of a kind of society, defining patterns of social organisation and interaction in contemporary urban life (Latham, McCormack, McNamara, & McNeill, 2009), through 'automobilised timespace' (Sheller & Urry, 2006: 209). Mobility can be liberating and empowering, but hypermobility has costs for society and the planet (Adams, 2001). One of those costs is the major sacrifices poor households have to make to meet the costs of owning and running a car in hypermobile dispersed towns and cities, where there are few viable transportation alternatives, meaning that car ownership is 'one of the items of household expenditure that cannot be foregone' (Banister, 1994: 7).

#### 10.4.2.1 Widening the conditions of possibility for coordinating everyday life

An approach, which favours cycling and also includes restrictions on car-use, forms part of Pucher and Buehler's (2008b) prescription for making cycling 'irresistible', an approach identified in Chapter 3, as being more advantageous than those incorporating vague policy aims of generating modal shift (Spurling & McMeekin, 2014). However, favouring cycling has limitations if the design of available bicycles does not support the achievement of load-carrying practices. The existing mass manufacturer of conventional bicycles is predicated on a leisure market, with the majority of the cargo-capable pedal cycles encountered in this research being manufactured by smaller, niche companies. Consequently, the mass marketers of bicycles are selling leisure, not decarbonised urban mobility or cargo-capable solutions to load-carrying need: a task which falls to the niche companies and activist home-builders. As Chapter 6 shows, homebuilders are a source of glocalization and innovation of cargo bike buillding and design, with niche companies like Christiania™, arising out of novel solutions to problem from outside the cycling industry, rather than insider innovation. Equally, modular solutions to load-carrying such as the Xtracycle™, which facilitates the ownership of a longtail by retrofitting an extender unit to a pre-exisitng bicycle, are examples of activist innovation, which seek to further the the inclusionary, affordable image of cycling, and challenge the hegemony of the leisure market, by responding to identified decarbonised load-carrying need.

The DRT in Portland (Chapter 7), uses a scenario to showcase the capabilities of cargo bikes in an environment which imposes physical restrictions on car use. The DRT is a form of indirect activism used to advocate for cargo-cycling as a 'lifestyle politics', which involves negotiating a tension between transforming daily living and embedding new practices within systemic norms, habits, and routines (Lewis, 2014). Cargo bikes afford a widening of scope for meeting daily mobility needs, which incorporate to varying degrees, cargo-capability, weather protection, and potentially the easing of spatial, temporal and corporeal constraints based upon the inclusion of for instance E-assist. Participants in this research are primarily people going about their normal daily lives, using cargo-cycling as a tool to widen their conditions of cycling possibility (Nettleton & Green, 2014), helping them to achieve multiple tasks without driving. Chapter 8 shows that **for already committed cyclists, the progression to cargo-cycling as a mechanism for meeting extended or more complex suites of needs, is already a condition of possibility**.

As Bourdieu (1977) shows, a practice theoretical approach homes-in on the conditions that make the doing of something possible, rather than barriers to achievement. The range of load-carrying need conditions the possibility of meeting that need by pedal cycle, and for different people, as identified in Chapter 5, that can mean quite different cargo capability. For instance, both PN2 and CH11 integrate tricycles into their performances of load-carrying, but for PN2, who lacks confidence in her balance but does not need to carry children, a conventional rear-load trike with a basket on the back meets her needs. For CH11, the safety of her baby is paramount, coupled with the ability to carry baby paraphernalia. Thus, the stability of a front-loader trike when stopping at traffic lights, and the ability to constantly maintain contact with, and monitor the baby in front of her is crucial. Without these affordances, for both these participants they would not be able to negotiate their need for stability, combined with cargo capability, on a conventional bicycle and both would, therefore, drive to meet their needs. Hence, the interrelated practices these practitioners need to perform 'have emergent consequences … for the careers of the practitioners involved' (Shove et al., 2007: 144), as with the affordance of a trike, they are able to continue to practice cycling rather than being "forced" to drive.

These variations have significance for people involved in planning for and facilitating decarbonised mobility. Pedal cycles such as the longtail, which can meet a spectrum of need, and overcome some of the problems associated with performing multiple practices, such as child transportation, shopping and commuting (Godefrooij et al., 2009; Mullan, 2012), have the potential to reduce defection, particularly for women, from cycling practices, due to life changing events such as the birth of a child.

#### 10.4.2.2 Replacing driving – disrupting practice consensus

The relationship between cycling and driving practices is intrinsically dynamic (Shove, 2014b). Historically, cycling has moved from being defined as fast, and a means of carrying loads when compared to walking, to slow and insufficient to carry loads when compared to driving, although urban congestion has in certain locations, precipitated a redefinition back to fast. In some cities, the image of cycling as normal has also endured, at least in a dormant form, capable of reawakening when other elements of the practice are addressed in policy. However, Shove (2014b: 10) argues 'deliberately engineering the demise of automobility' and its replacement with cycling to be a remote possibility. By contrast, attempts to reconfigure relations between cycling and driving practices are considered worthwhile. **Attempts to change**

**values and policy may nonetheless be futile if technology does not meet need**. Equally, seeking to transplant interventions, technology or values from one location or time to another, without accounting for local conditions, is also likely to lead to policy failure.

Crawford (2012), conceptualises cargo cycles in the car free city, as presenting a viable mode of transporting goods between shops and dwellings. This is broadly consistent with the CycleLogistics project finding significant potential for the growth in personal cycle logistics, with 70 percent of trips being for personal logistics purposes, and 40 percent of those trips having the potential to be shifted to pedal cycles, as compared to 30 percent of commercial trips (CycleLogistics, 2014b). In Copenhagen, Jensen (2013) finds cycle mobility to be an everyday form of authentic Danish urban mobility as significant for Copenhagen as automobility. Within this cultural norm, the development of the Christiania cargo trike in Copenhagen is presented as offering a spacious and capacious cycle technology relevant to 'family life' (p. 222). In the London Borough of Hackney, Martinez (2011) associates the normalisation of cycling, and potential demand for cargo-cycling, with low car ownership and use, and subcultural, environmentally, and politically inspired gentrification.

However, **for cargo-cycling to take hold as a pragmatic mode capable of countering lock-in to driving, in Anglophone countries, recruitment will be required from under-represented groups, including women** (Walks, Siemiatycki, & Smith, 2015). If it is true that women are an indicator species for growth in cycling (Baker, 2009), whilst women continue to be the main bearers of the combined responsibilities for childcare and household provisioning, then **increasing availability and recognition of cargo-cycling as a conduit for practice bundling, and as a means of enhancing well-being, has the potential to unlock some practices from their relationship to driving**.

Chapter 9 discusses the shared pulse of household members – the times and places where rhythms cross, which rely on achieving sufficient synchronicity in activities (Powells et al., 2014; Røpke & Christensen, 2013). Disruptions are argued to have the potential to reveal the flexible side of routines considered to be intractable (Trentmann, 2009). This suggests that interventions can be aimed at potentially flexible practices, which exhibit more elastic notions of load-carrying mobility,

consequently challenging normalised standards of load-carrying. However, such changes can only be achieved if people have the means to accomplish load-carrying in alternative ways (Kuijer, 2014).

Change in household rhythm, prompted by the birth of children, is a catalyst for home-building projects (Chapter 6), the resultant cargo bikes facilitating the continued accomplishment of household travel and load-carrying activities by pedal cycle rather than prompting increased driving. As a means of achieving activities normalised as requiring driving, home-building becomes one practice within a constellation of activities that potentially reinforce the visibility and viability of achieving load-carrying activities by pedal cycle.

The DRT (Chapter 7) points to the impracticality of relying on taken-for-granted driving practices to meet need in a post-earthquake scenario in Portland. As celebratory events, bringing together multiple elements of cycling practices, events such as critical mass, *ciclovía,* and DRT all seek to disrupt practice consensus around driving which normalises mobility based upon private motorised vehicles. The DRT, like Chapter 9, highlights the freight function of cargo bikes, their hybrid, transmodality, which allows the transportation of loads without reliance on carbon-intensive fuel sources.

Watson (2013) argues that the relationship between cycling and driving is, whilst interdependent, inherently competitive and that pedal cycles do not simply substitute for cars. In Chapter 9, I advance a more nuanced argument based upon the bifurcation of cycling practices to focus on the incorporation of cargo bikes into cycling practices. **Cargo-cycling is not a replacement for driving, but cargo-cycling does substitute for driving trips and cargo bikes can substitute for second cars.** Cargo bikes are important to women in avoiding at least temporary defection from cycling after childbirth, and for maintaining household cycling practices with young children. Cargo-cycling may increase defection from the practice of driving by facilitating the negotiation of need because **cargo-cycling bundles more easily into tighter complexes with the time and space constraints of the practices of shopping, commuting and child transport than do conventional bicycles** (Chapter 3). A practice with greater capacity for synchronisation with multiple other practices will be advantaged in a competitive and dynamic process of practice recruitment, maintenance and defection (Chapter 8). The DRT can be seen as an example of 'exemplary practitioners' championing a

practice as a showcase to help facilitate the recruitment of practitioners and defection from pre-existing practices such as driving (Chapter 6).

## 10.5 **Accounting for SPT**

The final component of this research concerns the application of practice theories to explore the decarbonisation of load-carrying manifest in cycling practices, assessing the implications of adopting an SPT framework to understand cargo-cycling as urban load-carrying mobility. Foregrounding practices as the unit of enquiry is an 'unusual step' (Harvey et al. (2012: 18), requiring careful consideration of the research issue and how it is problematised (Bacchi, 2012). In addressing the implications of adopting a specifically SPT approach, I am mindful of a number of positions, developments, critiques, and methodological and conceptual challenges of theories of practice, expressed in the contemporary literature.

As a theory which has gone through a period of recent development, it is acknowledged that the practice theoretical project is ongoing in seeking to provide a distinctive account of variations within practice. These variations include practice scale, relationships between practices, 'types' of practice, and how power works (Foulds & Jensen, 2014; Foulds, Jensen, Blue, & Morosanu, 2015), it being clear that theoretical positioning between the extremes of the structure agency dualism, creates a productive tension. That tension is particularly apparent in the development of SPT, which critiques the neo-liberal underpinnings and utility of the so-called attitude-behaviour-choice (ABC) models of behaviour, and the structural aspirations of transition management approaches. Such tensions pertaining to the field of sustainability, were both expressed in intense debate, seen in the journal *Environment and Planning A*, between Elizabeth Shove (2010a, 2011b) and Whitmarsh and colleagues (Whitmarsh et al., 2011) on the appropriateness of framing climate change as a problem of human behaviour and the forms of government such a model sustains, and between Shove and Walker (2007, 2008) and advocates of transitions *management* from STS (Rotmans & Kemp, 2008). These debates, particularly concerning behaviour-based explanations, still impact theoretical developments and the empirical use of SPT, as seen in recent commentaries on the so-called "weak" and "strong" applications of SPT (see for instance Shove, 2014b).

Ontologically, practice theories centre practices, dealing with shared, social, endogenous dynamics, and specific cultural and material histories, seeing relationships as reproductive and generative. Epistemological knowledge of the world is gained by probing the socio-material, non-individualist relationship between performance and wider society. By contrast, theories of behaviour are focused on individual choice and external drivers, and see relationships as causal. Divergent approaches have not prevented "weak" appropriation of theories of practice (in Shove's terms) to understand individual/user/consumer behaviour (see for instance Gram-Hanssen, 2010; Hargreaves, 2011; Spaargaren, 2004, 2011; Strengers, 2011; Wilhite, 2013). According to Shove (2014b), these are appropriations which either:

a. affiliate loosely to sociotechnical approaches distanced from behavioural accounts to explore the constraints 'scripted' into choices by material and environmental factors,
b. seek to develop more rounded, holistic accounts of individual behaviour moving beyond a focus on attitudes and values, or
c. try to understand local instances of a behaviour (see for instance Barr, Gilg, & Shaw, 2011).

Shove (2014b: 4) advocates an 'altogether stronger line' which centres practices in analysis as recognisable entities in time and space, to ascertain how they emerge, persist, and disappear. Strong applications, focus on the reproduction of practice entities themselves, dependent on localised performances by practitioners, while weaker applications are argued to concentrate only on moments of performance. Stronger applications thus privilege the recruitment and retention of practitioners to habituated practices, rather than habit as adopted behaviour by practitioners. Shove claims that weaker applications tend to substitute the term practice for behaviour, as a mechanism to signify the social construction of action, without attending to the dynamics of the growth, persistence, and demise of practices entities. Given Shove's conceptualisation, she holds that learning about the history of a practice, and how recruitment and defection takes place, has policy implications for long-term transformations (Shove, 2014b: 5), such as involved in the normalisation of the decarbonisation of load-carrying practices.

In this research, I have sought to address some of these issues raised by Shove, by attending to growth and change within load-carrying practices, taking note of recruitment in Portland and Christchurch, and identifying cargo bikes as a mechanism of defection-avoidance for cycling as a load-carrying practice. I have

attended to the absorption of technology into cycling practices, how cargo bikes are used and embedded, and the collaborative and competitive aspects of the rhythmic bundling of practices in timespace. In focusing on the relationships between practice performance and practice entity, and the role of practitioners in both bringing practice elements together and acting as the crossing point of practices, I have adopted several techniques to operationalise SPT, which have implications for the research. I now expand upon the implications of adopting a SPT approach in understanding the use of cargo bikes in urban load-carrying mobility.

### 10.5.1 Operationalising practices as the unit of analysis

#### 10.5.1.1 What counts as a practice?

In the same way that there is no one definition of practice theory, there is no precise mechanism for delimiting (Røpke, 2009) or deciding what 'counts' (Shove et al., 2012: 121) as a practice. Shove et al. (2012) suggest in common with Schatzki (2002), that the practice must be "living" to be considered a practice, but present minimal advice on what counts as a practice - 'anything that practitioners themselves take to be such' (p. 121). Thus, researchers need to use their own judgment, leaving practice constitution open to empirical interpretation (Horne et al., 2011). Røpke (2009) highlights the difficulties in setting the boundaries between practices, in deciding when practices can be considered separate and when they should be considered practice-variants. Keeping the framing wide enough allows attention to be given to alternatives, while at the same time being able to isolate a sub-group of practitioners, enables the 'capture' and analysis of the target practice. For this research, these framing possibilities inherent within practice theory, have facilitated consideration of cargo cycling as a practice-variant, but also the wider practice of load-carrying based upon the relationship between driving and cycling.

Watson (2012: 495), in his consideration of 'velomobility', characterises niches of innovation in cycling practice as sub-cultural manifestations of the proliferation of cycling practice. In the empirical chapters, I settle upon a language of bifurcation to explore that sub-cultural variation, where I regard cargo-cycling as a recognisable practice-variant of cycling, in the same way, that cycle-touring is a recognisable but specific form of cycling, both incorporating common but also disparate elements of equipment, meaning, and competence. Cargo-cycling is distinguished from other cycling variants, partly by its freight function but other practices like driving can also

have a freight function. Thus, in focusing on cargo capability, cycling and driving can both be regarded as practice-variants of load-carrying.

#### 10.5.1.2 Combining approaches and methods

A number of intellectual resources and methods can be employed in examining practice trajectories. Maintaining focus on the practice as opposed to practitioners is a demanding process, as the observation of a practice occurs through engagement with, and observation of, practitioners at moments of performance. It is clear from the number of so-called weak applications of SPT, that this is no easy task and therefore, requires vigilance. While consistent self-checking has been employed in this research, to endeavour to maintain the practice gaze and probe problem representations, there is nevertheless a danger of concentrating on local performance as behaviour, rather than the implications of local performance for the practice entity.

Following Harvey et al. (2012) and Warde (2005), this thesis adopts breadth in method to probe scales of distribution and variation of load-carrying across sites, spaces and time, which includes comparative and historical components. Participant observation and interviews are primary sources of enquiry into practices as entities, via people performing daily practices. While documentary analysis, and learning about the history of practice recruitment and defection are important research techniques, as Hitchings (2012) shows, interviews are sometimes dismissed as being unsatisfactory, after the fact representations of what took place, not sufficiently de-centring of the individual, and with the potential to frame the boundaries of what is thinkable (Nettleton & Green, 2014). Like Hitchings, I suggest that talking about practices is a route to accessing the 'wants and emotions' (Schatzki, 1996) vested in practice, and an efficient means to understand 'how it is to embody certain practices' (Hitchings, 2012: 66), who participates, how they learned, and from whom.

These methods can be complemented by other methods, which are capable of capturing how practices bifurcate into new variants (Harvey et al. 2012). This research, in the application of QM, has used photographs as 'an alternative route to knowledge' (Pink, 2012: 35), including engaged participant observation of the sorting practice, at least in part decentring 'minds, texts and conversations' (Reckwitz, 2002: 259) in 'unfolding a practice theoretical approach', by implicitly focusing on 'objects or the observable level of physical materiality' (Pristed Nielsen & Møller, 2014: 5-6). QM, in treating participants as the variables, moves focus from individual

practitioners to the sub-cultural practice-variants of the recognisable practice entity in which they participate. Such a technique helps to draw out how load-carrying is featured and embedded in mobility practices, becoming a "trace" (Harvey et al., 2012) of those other practices that interweave with riding cargo-capable pedal cycles. The social and technical significance of the introduction of new technological resources, therefore, depends on how they are positioned relative to pre-existing practices: patterns of demand can consequently be understood as *traces* of interacting practices (Browne, Medd, & Anderson, 2012: 1032). The application of photograph-based QM accompanied by post-sort interviews captures rich insights into complex bifurcating practices. Identification of the four statistically significant factors presents a powerful way of exploring practice variation, which here serves as a sensitising process (Bacchi, 2009) for further investigation (reported in the subsequent empirical chapters). The factor depictions (Figures 5-2 – 5-5) used to illustrate the practice-variant descriptions aid understanding of the nuances of intra- and inter-practice variation, based upon objects as observable manifestations of practice (Pristed Nielsen & Møller, 2014).

#### 10.5.1.3 Zooming

The research design responds to Nicolini's (2009b) suggestion, to adopt a theory/methods package which zooms in and out 'on the data and between data and theory' (p. 120), between practice performance and practice entities as they coexist in space and time until a coherent picture emerges. Zooming, as a recursive technique for inter- and intra-practice movement is used here to both move within the empirical data collected for this study, and to move between theory and data to follow what Nicolini (2009b) calls 'trails of connections' (p. 121) to explore the what and why of practices, and multi-directional practice relationships. As Nicolini identifies, **zooming is effective in centring the practice(s), and dislodging attention from the practitioner**.

Taking an SPT approach regards the taking up of practices in different temporal and spatial locations, as a process of reinvention rather than diffusion (Shove & Pantzar, 2005). Zooming-in on individual performances of practices has dominated recent practice-theoretical accounts (Warde, 2014). Zooming-in, allows attention to focus on the competences necessary to perform a practice, centring the performance, and subtle changes between performances in a particular location in time and space. It also allows scrutiny of the relationships between elements of the practice, such as between practitioners, materials, tools, and competence, and the normative images

of rules and norms. Zooming-in shows where practices rely on alternative/complementary practices, and conversely where one practice constitutes the resources for another (Nicolini, 2009b). Zooming-out attends to practice entities and the intermingling and congealing of multiple practices within circuits of reproduction.

In this thesis, I account for cargo-cycling as a competing and overlapping practice-variant of cycling which has the potential to meet need for load-carrying in urban environments. The process of zooming-in and out in Parts A and B has afforded the development of a diagrammatic elaboration of the conceptual framework of SPT which builds upon the zooming analogy in a topological form. This elaboration is developed in the practice summaries found at the end of each of the empirical chapters found in Part B, and brought together here (Figure 10-1). Part C therefore, accomplishes the final zooming-out process for this thesis, a zooming–out which incorporates all the knowledge gained from the zoomings-in from Part B. The topological expression of the practices investigated in this thesis, presents a new mechanism for visually expressing practice relationships, at a practice and elemental level. In drawing together the individual empirical chapters in an overall diagram, the individual chapters are presented in colour to reflect the specific relationships identified between and within practices in those chapters, while the tentative, fluid, potential relationships inferred from zooming-out from the empirical chapters are presented in grey-scale. This mechanism reflects both the zooming-in on practice configurations and emerging connections.

Developing a topological diagram, which reflects relations unaffected by continuous change in shape and size to concentrate on interrelations, is a development of practice theory which expands and contributes to the articulation of theory at an empirical level, as a holistic unit of analysis of inter- and intra-practice relations. This diagrammatic representation emphasises the dynamic qualities of practices, bifurcation, hybridisation, and the exogenous components of recruitment and defection to and from practices (Watson, 2012), a focus which accounts for interconnections between practices, and the impact of dominant practices (Macrorie, Daly, & Spurling, 2014). This schema supports responses to criticisms of SPT, which go beyond the study of individual practices, to emphasise co-location and co-dependence, and the emergent properties of such relationships (Shove et al., 2012).

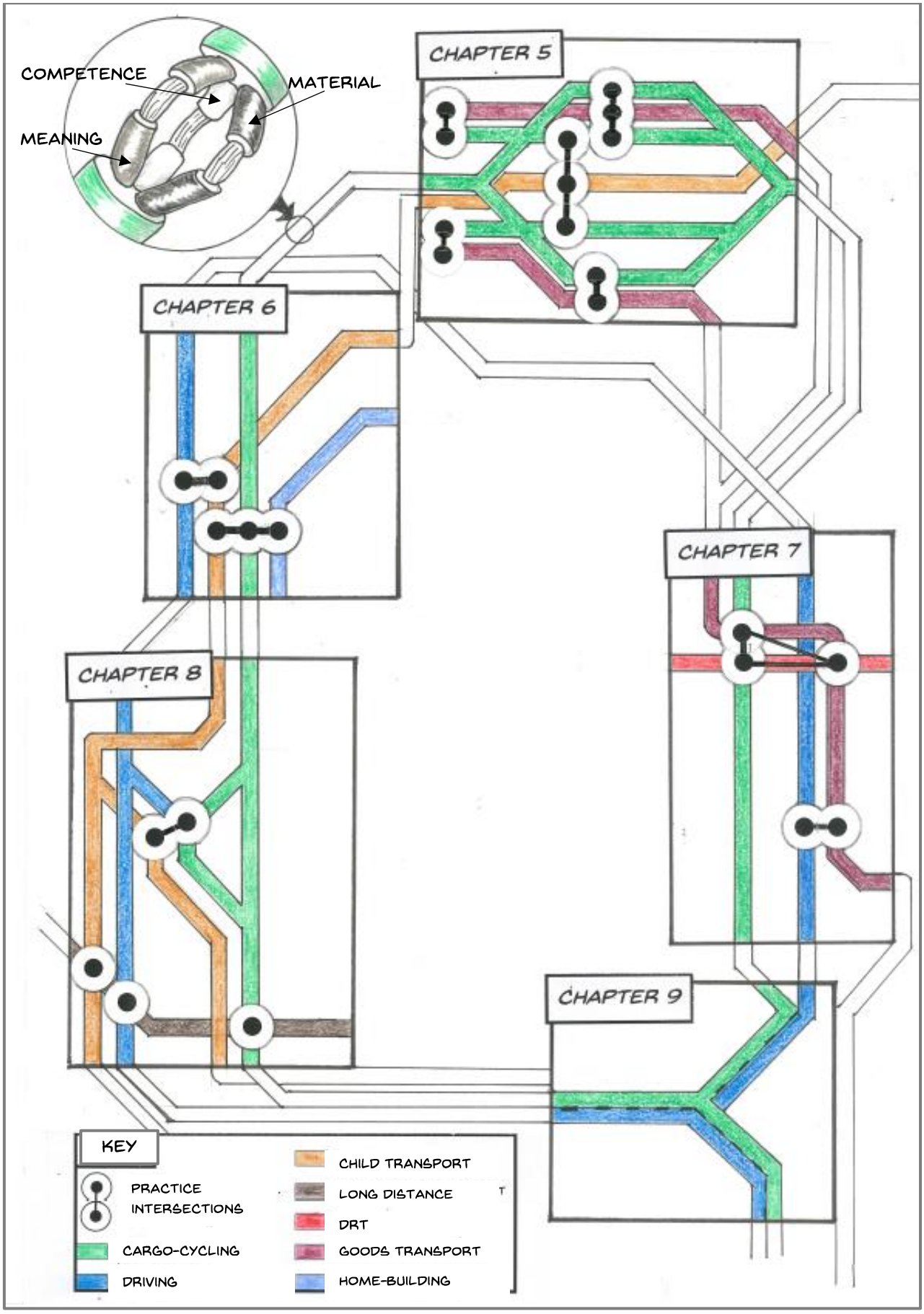


**Figure 10-1 The contribution cargo-cycling has been found to make to urban mobility**

### 10.5.2 Performance and entity relationships

Earlier sections of this thesis (see especially Chapters 1 and 3), advance a number of reasons for applying a practice-theoretical approach to load-carrying, as specifically manifested in SPT, to conceptualise the dynamics of 'social order, stability, and change' (Shove et al., 2012: 119). It is evident from the findings of this examination of load-carrying practices **SPT offers a workable and useful alternative to understandings founded upon the structure/agency dualism**, based upon the recursive relationship between entity and performance. In this relationship, the responsibility for engaging in particular practices is located with the participants performing and reproducing practice entities, *and* with elements which compose that practice.

Particularly important for this study, is the inclusion of materiality as a constitutive practice element within SPT's tripartite conceptualisation of practice elements. This foregrounding means products are 'increasingly viewed as essential ingredients in the effective accomplishment of everyday life' (Watson & Shove, 2008: 69). A practitioner or carrier of a practice (Shove et al., 2012), holds a distinctive position as the conduit (Aldred & Jungnickel, 2013; Hinton, 2010) and 'unique crossing point of practices' (Reckwitz, 2002: 256) that people perform in the course of their daily lives. In many situations, the successful performance of a practice depends on the active participation of more than one practitioner and therefore, social interaction is a core aspect of practice (Christensen & Røpke, 2010). Accordingly, dominant practices 'can only emerge, persist and gain dominance by colonising what people do' (Watson, 2012, p.: 492), with demand being an outcome of those doings (Walker, 2014b: 49). Such a conceptualisation, moves closer to Latour's (2000: 113) positioning of materiality as 'a large part of the stuff out of which socialness is made', than to Giddens' (1984) thoroughly social theory, and Schatzki's (2009) locating of materiality as a mooring to which practices are tied. Thus, in situating the social as emergent from flows of practices, the social is emergent from the linking of elements, including material elements, know-how, and meanings in the performance of a practice, and the transcendent entity spanning all recognisable performance of a practice. **A strength of practice theory is that it makes elements, links, and associations visible,** rather than as normalised parts of an opaque indivisible whole. This conceptualisation allows the positioning of both cycling and driving as overlapping practices, in the sense that they have a social location as a mechanism for transporting human bodies (Watson, 2012), and equally important for this

research, as a means for moving other material things. Practice theory, therefore, facilitates conceptualisation of the integration of elements in mobility practices (Kent, 2014; Watson, 2012), and oversight of practices as 'ordering and orchestrating entities in their own right' (Shove & Walker, 2010: 471), bundling with other practices. However, the dynamic relationship between human and non-human complicates attempts to analyse practice change by following the circulation of elements independently of their hybridisation and incorporation within their enactment (McHardy, 2012; Pantzar & Shove, 2010b). Consequently, trying to conceptualise practice as an entity risks 'skipping over the tensions that necessarily arise between normalising practices and the multiplicity of specific practical enactments' (p. 143), a risk that may be countered by foregrounding bifurcation.

In making visible the elements and linkages of practices, marginalised and marginalising practices can be dissected and probed to confront this issue of polarisation between the normal, and by inference the non-normal other. Scrutinising the links and elements, but more importantly, bundles and complexes of automobility, opens up possibilities for predation, by exposing weaknesses that may become visible when the whole becomes divisible. Bundles and complexes, in this scenario, become important, as acquiring previously unconnected practices from the bundle, and binding them into a complex, offers a challenge to a normalised way of doing. Thus, for instance, running a business from a cargo bike is an active process of adding a practice from the bundle and making it part of a complex. This process is reflected in cycle freight movement in Europe (section 2.6.1), associated with electric vans, micro-hubs, and canal boats, where new complexes are being formed from a bundle of pre-existing practices.

### 10.5.3 Looking for change

Two main criticisms have been made of social theories of practice: their perceived focus on 'doing' at a micro level, and that they are better at investigating stasis (reproduction) following the development of individual practices over time, rather than change (Watson, 2012). More recent work is credited with furthering insights into how practices change (see for instance Gram-Hanssen, 2011; Magaudda, 2011), and the relationship between performance and entity (Halkier, Katz-Gerro, & Martens, 2011), and Shove et al.'s development of SPT emphasises the dynamics of practices, the mobility as well as the persistence of elements and the linkages between them. They show how 'the contours of practices-as-entities evolve (even

when practitioners and performances are separated in space and time)' (p. 122). Using this theoretical approach has demanded following cargo bikes as they become 'embedded in different social practices' (Shove et al., 2013: 9), pinpointing the cross-over and convergence of elements between practices which demand cargo capability, and facilitating the study of the integration, disintegration, and transferral of practices (Maller & Strengers, 2013) in time and space.

To shed light on the potential for equitable change towards the decarbonisation of transport and climate change mitigation, practice theories need to show that they are capable of accounting for social, spatial, and temporal change. While Schatzki's flat ontology stresses practices being 'the source and meaning of normativity' (Schatzki et al., 2001: 12), a more ordered and dynamic approach, views practice as being capable of accounting for change (Warde, 2005; Warde, Cheng, Olsen, & Southerton, 2007) with differences between performances of a practice containing 'the seeds of constant change … [practices] are dynamic by virtue of their own internal logic of operation, as people in myriad situations adapt, improvise and experiment' (Warde, 2005: 141). Combining SPT with other concepts, such as forced car ownership (Chapter 8) and indirect activism (Chapter 7), and invoking QM to investigate practice bifurcation in variants or sub-practices (Chapter 5), helps to fill gaps identified in the literatures identified in Chapters 2 and 3, stretching the ontological boundaries of practice theory (Birtchnell, 2012) to deal with scale and complexity. For example, this research clearly highlights the role of time and space in practices, and the relationship between hybridity and bifurcation of practices, and 'uneven webs' of co-dependence (Shove et al., 2012: 94), continually rewoven as practices reproduce.

To adequately account for a practice transition requires effective representation of the circulation of shared elements, and varied, necessarily localised, historically specific integration (Shove & Pantzar, 2005; Shove et al., 2013). But as Hardy (2013) notes, and as pointed to in Pantzar and Shove (2010b), the dynamic quality of relationships between humans and non-humans complicates analysis of practice change, by tending to follow the circulation of elements independently of their hybridisation and incorporation within performance.

Watson (2012), as the main proponent of a systems of practice thinking, argues for consideration of the exogenous components of recruitment and defection to and from

practices, and changes in the elements making up a practice. He conceptualises the shifting relative location of practices, as part of the operation of broader systems of practice. Applying systems thinking to practice is not new in the SPT literature, with Shove (2009), considering the rate at which practices might be changing and 'the relative plasticity or rigidity (lock-in) of the interlocking systems of practice of which society is composed' (p. 30). Pantzar and Shove (2010a) regard systems or networks of practice as constructions resulting from individual practices, in the same way that elements form the raw materials of individual practices, in a recursive relationship between system, practice, and elements: a focus on interconnections between practices and the impact of dominant practices on 'reproduction, reinforcement and transformation in social life' (Macrorie, Daly, & Spurling, 2014: 16). Watson develops systems of practice ideas as a response to criticisms of practice theory, and to engage SPT with sustainability interventions, by seeking to enable analysis and understanding of change in complex systems using practice theory to understand socio-technical system change. Hargreaves, Longhurst and Seyfang (2013) take a different approach in seeking out SPT's intersections with the multi-level perspective (MLP) by maintaining the flat ontology of SPT, to find intervention points to promote recruitment to sustainable practices, and defection from undesirable practices,` and 'to account for the local embedding and global interconnectedness' (Shove et al., 2013).

Systems of practice encounter similar issues of delimitation, as encountered in the defining of practice boundaries. Arguably, a system of practice is no more than an umbrella term for more than one practice. It is not yet apparent how the term can be understood as fundamentally different from bundles and complexes of practices, with bundles describing no more than co-location, and complexes co-dependent 'constellations that are hard or impossible to separate because different practices are "functionally" (or mentally) integrated' (Pantzar & Shove, 2010a: 26). Fundamentally, in responding to criticisms regarding SPT, Watson, in advancing a systems of practice logic is addressing issues beyond the study of individual practices, focusing on co-location and co-dependence, the emergent properties of such relationships, practice variation, practice dispersal, and cross-sectoral analysis of the impact of policy-making on the practices which constitute daily life (Shove et al., 2012). An alternative but complementary approach to dealing with these issues - the 3 Es - is advocated by Birtchnell (2012), as expanded upon in Chapter 7. This tripartite conceptualisation is a useful tool for investigating practice consensus

destabilisation. The DRT is analysed as an exemplar of indirect activism, which seeks to encourage scaling and direct change via demonstration of alternatives. By showcasing the appeal and utility of cargo-cycling practice, in action as well as rhetoric, exemplary practitioners challenge existing dominant practices. In the case of DRT, the aim is to embed suites of alternatives in the present, to increase future resilience.

### 10.5.4 Dealing with inequality and cost

As Walker (2014a) makes clear, SPT is not inherently egalitarian and thus far has not focused on issues of social justice and inequality. Indeed, SPT 'lacks a sense of critical or normative positioning. It is analytical and diagnostic, but rarely politically engaged' (Walker, 2014a: 50), tending to bypass issues of social difference and exclusion from practice performance. Thus, while social practice theorists identify the 'blind spots' of policy formulations, based upon behaviour change and technological substitution initiatives (Shove, 2014a), I follow Walker in arguing that failure to attend to issues of social justice and inequality is currently a 'blind spot' for SPT. Taking a different approach to Walker's (2013, 2014a) articulation of Sen's capability approach with SPT to address the inclusivity or exclusivity of practices, I attend to the social justice implications of affordability and cost by placing the social exclusion and car dependence literatures in productive tension with SPT (Chapter 8).

In Chapter 1 the point is made that cycling is generally regarded as affordable, costing 'far less than both the private car and public transport, both in direct user costs and public infrastructure costs' making it 'among the most equitable of all transport modes' (Pucher & Buehler, 2008b: 496). Chapter 2 shows that in terms of cost, range, and payload, E-assist cargo bikes are positioned between, and overlap with pedal cycles and cars (Gruber et al., 2014). Chapter 3 notes, that recruitment and defection to and from cycling and driving are constrained by, and compete for finite practitioner time and money resources, as well as for urban space, and through competing discourses of for instance, safety, health, environmental responsibility, convenience, and social status (Shove, 2012; Watson, 2012, 2013).

From a practice theoretical perspective, people's lives 'hang together' through practice, moving the focus from demographic characterisation, such as age, sex or income, to the suite of practices that those people engage in, 'and from which the

arrangements and orders which constitute such categorisations emerge and are reproduced' (Everts et al., 2011: 331). As Walker notes, while one practitioner can participate in a number of practice communities, issues including cost will necessarily have inclusionary and exclusionary potential. While social inequalities are not specifically excluded from analysis, Everts et al. argue that in attending to the site-specificity of practices arrangements, geographers are well placed to analyse how the organisation of practice includes and excludes. Given that the explanatory power of the social inequality of unequal income is a limitation of practice theory, the challenge of endeavouring to show how such inequalities reside in and are produced by practices such as mobility is a valid aim.

Women, children and those on low incomes are most likely to face mobility restricted by the dominance of driving (Godefrooij et al., 2009), impacting access to employment and other activities. Time poverty, being strongly associated with childcare responsibilities and employment, can generate isolation, and reduced well-being (Currie & Delbosc, 2010). Women's travel patterns are more likely to require trip-chaining to multiple destinations, and the carriage of groceries, children, and other cargo (Chapter 2). The benefits of individualised mobility accrue to those who can afford it, but as shown in Chapter 8, lack of alternatives may 'force' car ownership onto low income households (Aftabuzzaman & Mazloumi, 2011) causing car-related economic stress. With cargo bikes being situated between cars and conventional bicycles in terms of load-carrying and cost, the cost of cargo cycles becomes a major focus of discussion as a barrier to bike use (Godefrooij, Pardo, and Sagaris, 2009). In Christchurch, Portland, and also Copenhagen women are identified as instrumental in identifying the benefits of cargo cycles (Chapter 8):

> mums … can see what the benefits might be. Cost is a major factor … I know plenty of people who are considering it once they've got their finances a bit sorted, that's what they'll be looking at doing … it's got people thinking and these thing all take time … it's in their one or two year plan. (CH8).

Participants in Portland argue longtails to be resurgent, based on increased choice and relative affordability when compared to some front-loaders, making them more financially achievable to people who are unable or unwilling to sell a car to purchase one: 'the power behind movement is in longtails, not front-loaders' (PO7). Building a cargo bike reduces costs, and facilitates experimentation for participants in Christchurch at times of increased household size and expenditure (Chapter 7). However, this is only an option for some nascent cargo-cyclists, although initiatives

to empower people in the use of tools and building techniques are identified as worthwhile in Portland and Christchurch (section 6.5.2).

I argue that **cost should be recognised as a core component of the elements of a practice such as cycling or driving, which can be a strand of competence and image.** Consequently, cargo-capable cycling requires the financial competence to afford a cargo bike whether or not based upon purchase of a commercially produced model. **In locations where owning more than one car has become close to a condition of participation, cargo bikes, once afforded, have the potential to significantly reduce the proportion of the weekly budget that has to be dedicated to mobility**. Moving beyond identifying inequalities in societal participation, to proposing solutions, requires understanding of how people do practices in the now, *and* how changing conditions of possibility might influence doing in the future (Mullen and Marsden, 2014). Chapter 8 shows that understanding how cargo bikes can and do fit in to mobility practices opens possibilities for intervention where cargo bikes can form part of a more equitable and sustainable transport system. For those currently experiencing lock-out from decarbonised, sustainable, and equitable mobility practices, such solutions need to embody a capacity to do decarbonised mobility, which does not exacerbate existing inequalities and perpetuate exclusion.

### 10.5.5 Policy interventions

While social theories do not lead directly to policy prescriptions, they do permit understanding of policy problematisations, and the types of policy interventions that in different jurisdictions are regarded as 'possible, plausible or worthwhile' (Shove et al., 2012: 139). Climate change and phenomena such as peak oil and peak car potentially widen the feasible policy interventions and outcomes associated with the health, economic and environmental-based promotion of less car-dependent lifestyles (Goodwin, 2012: 15). Increasing the number of urban trips made by pedal cycle is one such policy response (Burke & Bonham, 2010). However, despite assumptions, implicit and explicit in recent cycling related policy and research, that cycling mode share can be increased by infrastructural and social mechanisms (Oosterhuis, 2014: 20), evidence is not conclusive with demand elasticities for commuting remaining low (Banister et al., 2012; Oosterhuis, 2014; Walker, 2014a). Hard and soft behavioural policy measures, focused on individual attitudes and actions have thus far lacked effectiveness, being shown to be sub-optimal, with little

lasting influence, and then only over small spatial and temporal and cultural scales (Banister et al., 2012; Cairns et al., 2008; Evans et al., 2012; Southerton, McMeekin, & Evans, 2011). These prescriptions have tended to tackle symptoms such as cycling facilities ,rather than underlying problems (Dickinson, Kingham, Copsey, & Pearlman Hoagie, 2003). Such observations have led to debate about the causes of policy failure (Aldred & Jungnickel, 2014), resonating with Cartwright and Hardie's (2012) view on evidence based policy, that what works in one location, will not necessarily work in another.

Practice theories offer a fruitful, alternative way of integrating social, political, and economic relationships into analysis and policy (Vivanco, 2013a). Considered to be difficult to apply to policy (Warde, 2014). theories of practice have thus far had little influence on policy (Shove et al., 2012). SPT understands the constitutive elements of practices, rather than practices themselves, to travel in space and time, brought together in recognisable but locally specific practice performances. Consequently, SPT challenges ideas of direct policy transfer. Spurling and colleagues (see Spurling & McMeekin, 2014; Spurling et al., 2013), have sought to develop practice theory/policy linkages, identifying both the ideas already present in policy, consistent with a practice theoretical approach and how policy might look if it was informed or redirected by practice theory. Like Soron (2009), SPT specifically critiques the reliance on technological fixes and behavioural change found to be the mainstay of environmentally sustainable mobility policy initiatives (Barr & Prillwitz, 2014; Spurling, McMeekin, Shove, Southerton, & Welch, 2013), used to challenge the system of compulsory automobility (Soron, 2009: 181).

Instead, **SPT focuses on what people actually *do*, and in this way is broadly consistent with Bacchi (2009), in advocating an approach to policy analysis which analyses problem representations, not problems**. SPT questions taken for granted assumptions, individual 'responsibilitisation' (Sayer, 2013; Walker, 2014a) of problems, solutions, and change (McMeekin & Southerton, 2012), to ask how for instance, cycling can be encouraged, rather than why things occur. This is one of the ways **social practice theorists identify the 'blind spots' of policy formulations based upon behaviour change, and technological substitution initiatives (Shove, 2014a).**

Existing policy and academic focus on cargo bikes in Western countries, shows a focus on commercial logistics, primarily in the EU. SPT reinforces the importance of looking beyond the purchase of new products, to investigate how they are used and embedded within existing nexuses of practices (McMeekin and Southerton, 2012: 358). SPT is identified as offering three ways of addressing problem representations in policy, by recrafting practices, substituting practices, and changing how practices interlock (Spurling & McMeekin, 2014; Spurling et al., 2013). Recrafting practices is based upon intentionally recrafting the elements which form a practice. Substitution of practices discourages one practice while favouring another, to negotiate the accomplishment of needs and wants. Such an approach, in favouring cycling and also restricting car-use, is consistent with Pucher and Buehler's (2008b) prescription for making cycling 'irresistible'. Spurling and McMeekin (2014) claim an advantage of this form of intervention to be its specificity, rather than a vague policy aim to generate modal shift. While all three re-framings seek to grow desired practices, a hierarchy is assumed whereby targeting the interlocking of practices which generate an overarching need for mobility (Spurling & McMeekin, 2014), is seen to be the most important framing which seeks to re-negotiate the need or demand for mobility (Shove, 2003a; Strengers, 2011).

Shove (2014a) suggests, that rather than promoting a particular type of vehicle or mode of transport, 'it might make better sense to identify and actively promote sets of practices' into which a decarbonised mobility might fit: 'solutions tailored to different applications' (Cox, 2012: 7). A similar point is made by Clifton (2004) who foresees 'approaches targeted to the "bundle" of needs in low-income communities' (p. 411) to be potentially more effective than piecemeal policy approaches focused on automobility. Aldred et al. (2015) surmise that a deliberate targeting of under-represented groups may be required in both infrastructure and policy to ensure increases in mode share do not perpetuate existing inequalities and imbalances. Findings concerning the congealing of load-carrying practices and their significance for women support these assertions.

Learning about the history of a practice, and how recruitment and defection takes place has policy implications for long-term transformations (Shove, 2014b: 5). Forms and opportunities for policy interventions are emergent facets of the pre-existing system that policy makers seek to impact upon (Shove, 2014b) - the practices which constitute daily life (Shove et al., 2012). While issues such as reducing

unemployment, welfare dependency, and criminal activity remain higher up government policy agendas than promoting cycling (Elster, 2003), specific measures which link mobility to these political priorities may attract more government interest. **Cargo-cycling can thus become a tool to address community needs rather than increasing cycling levels being the sole policy focus**. **Attempts to change values and policy may nonetheless be futile if technology does not meet need**. Alternative cycle designs may be wider, longer, faster, more or less manoeuvrable, and easier or harder to start and stop, with consequences for the performance of cycling in a built environment. If policy continues to cater for the assumed needs of cycling based upon 'normal' diamond-framed bicycles, infrastructure may both become obsolescent, by not catering to the operational characteristics of alternative designs, and de-incentivise cycle design innovation (Cox, 2012). Ultimately such stifling constraints may negatively impact the rethinking of mobility. Equally, seeking to transplant readymade interventions, technology or values from one location or time to another, without accounting for local conditions, may also increaase the likelihood of policy failure.

## 10.6 Summary - Reconfiguring load-carrying practices

This chapter has drawn together the findings from the empirical chapters in Part B in the context of pre-existing scholarship on load-carrying outlined in Part A, to address the contribution cargo-cycling can make to decarbonised urban mobility. Thus, having zoomed in on particular aspects of load-carrying in Part B, this chapter has zoomed out again to place those findings within the context of the original objectives as formulated in the research question. In approaching this research in the context of transport system decarbonisation, using a practice theoretical framework, I have sought to both reframe the problem and the opportunities for intervention to 'engender recruitment to contemporary practices' of socially, environmentally and economically sustainable modes of decarbonised mobility, which can operate in the existing socio-technical landscape (Watson, 2012).

Consistent with a practice theoretical epistemology and ontology, this chapter has addressed those questions by accounting for recruitment to and the persistence of cargo-cycling, and the integration and scaling of cargo-cycling with other practices in the face of the dominant mobility practice of driving. Not only has this focus facilitated insights into cargo-cycling based upon what practitioners actually *do* in their daily lives; it has also supported the interrogation of SPT as a way of thinking

about mobility. This way of thinking, drawn together in a topological diagram (Figure 10-1) presents a new mechanism for visually expressing practice relationships at practice and elemental levels.

As Urry (2012: 534) reminds us:

> There is little doubt that future 'low carbon innovation' will … require 'consumer communities' coming to highlight, advocate, develop, make fashionable and synchronise actions and objects across diverse scales and socio-economic practices … developers are often not simply users but enthusiastic experimenters, making tiny modifications to goods or services that contingently begin to 'fit' together. The 'uses' of what turn out to be important innovations are often unpredictable, unplanned and undersigned … many 'old' technologies do not simply disappear but live on and are combined with the new in a reconfigured and unpredicted system. The innovation of a post-oil/post-carbon transport system has to become an object of consumer fashion and not simply 'loss' … it has to be a system that is fashionable and faddish, that wins hearts and minds, and that is better and more fun.

Practice theory highlights opportunities for turning questions around, adopting alternative models of understanding and intervention which are not predicated on only behaviour change and/or technological fixes, but instead account for the constitutive elements of practice-as-performance and entity (Browne, Pullinger, Anderson, & Medd, 2013: 14). This analysis highlights opportunities for understanding both changes in the relationship between cycling and driving and potential for intervention in that process. Rather than focusing on changing attitudes towards cycling, this research has focussed on the elements that combine to form practice, ranging from individual performance to the recruitment, retention, and defection of practitioners from the practice entity, and the socio-cultural-technological-regulatory changes that underpin and shape those performances.

# Chapter 11 Conclusions

## 11.1 Summary of the research

This thesis has addressed the decarbonisation of mobility practices, based upon the meeting of everyday load-carrying need, using cargo-capable pedal cycles. Beyond reviewing the extant literature on cycling as a means of achieving decarbonised mobility, this research has also accounted for how practice theoretical analysis has already been applied to utilitarian cycling. While the literature recognises the potential for cycling to offer affordable, sustainable and equitable urban mobility, relatively little attention has been given to the material affordances of specific pedal cycle types and designs. Where the pedal cycle has been brought into view, most attention has been given to its role in the European Union, and in commercial logistics. In this thesis, an analysis of load-carrying specifically focused on cargo bikes in the domestic realm has been advanced, which moves beyond Europe to New Zealand, with a "stop-over" in the United States. This research also moves beyond the common cycling research preoccupations with infrastructure, and attitudes and behaviour, to apply a practice theoretical frame to the research question: **what contribution can cargo bikes make to decarbonised urban mobility?** This approach centres practices, and importantly for this research, emphasises the inherent role of things or materials in daily life (Shove et al., 2012). Collectively the findings contribute to the wider body of knowledge on urban cycling, the relationships between cycling and driving practices, and the practices that cycling needs to mesh with, in order to present a realistic alternative to driving, in meeting domestic logistical needs in the urban environment.

## 11.2 Collective contribution of this thesis - the potential for cargo bikes to support decarbonised urban mobility

This thesis is more than a compilation of separate sections and chapters, being in sum a synergistic body of work which contributes to the urban mobility literature in a number of ways. Rather than a linear progression, the chapters present a zooming-in and -out on aspects of load-carrying by pedal cycle, and the relationship between cycling and driving in load-carrying practices. Relationships can be identified between the empirical chapters, and between those chapters and the theoretical and methodological underpinning of the thesis, and its situation within the wider body of work on urban utilitarian cycling and practice theory. Focusing on the *doing* of cargo-capable cycling, this thesis is compatible with Banister, Givoni, MacMillen,

and Schwanen's (2013: 280) call for a focus on the opportunities and benefits that low carbon mobility presents in overcoming lock-in to contemporary normalised mobility models, rather than dwelling on the disadvantages and dis-benefits of those models. The relationship to the wider field of human geography is seen in the spread and intensification of cargo-cycling as localised, broadly simultaneous instances of reinvention of the practice in different communities (Jackson & Everts, 2010). Investigating cargo-cycling as a social practice, is an appropriate starting point for studies of the geography of mobility for load-carrying purposes, allowing insights into the conduct of everyday life, the nexus between place and everyday activity (Thrift, 2003), with everyday life emerging from connections between place and practice (Everts & Jackson, 2009; Schatzki, 2002). Thus, cargo-cycling is understood as part of the continuum of transport technologies and practices, interlinked within a 'greater set of possibilities' (Cox & van de Walle, 2007: 117; Nettleton & Green, 2014).

## 11.3 **Summary of contribution and key arguments**

Overall, this thesis presents a series of 38 interlinked findings (Figure 11-1) previously examined in Chapter 10. These findings were derived by zooming-in and out on practices of load-carrying within urban mobility, moving between individual performances and their relationship to overlapping practice entities, as expressed in the complex rhythms of daily life. Articulated in the visual affordance of a topological diagram, which enhances the legibility of SPT and a practice-based analysis of cargo-cycling, this thesis can be summarised as a complex evolving intersection of practices, where zooming-out presents an apparently unified whole, while zooming-in exposes structure, the periodic drawing together of elements in practice performance, and their attrition in space and time. Each section of this thesis develops a portion of a conceptual framework, zooming-in and out between elements of practice, the practice space occupied by load-carrying practices, and illuminating a portion of the wider practice network. In this conclusion, this conceptual platform is drawn together, as an amalgam of the theoretical arguments and empirical understandings gained in the course of this research.

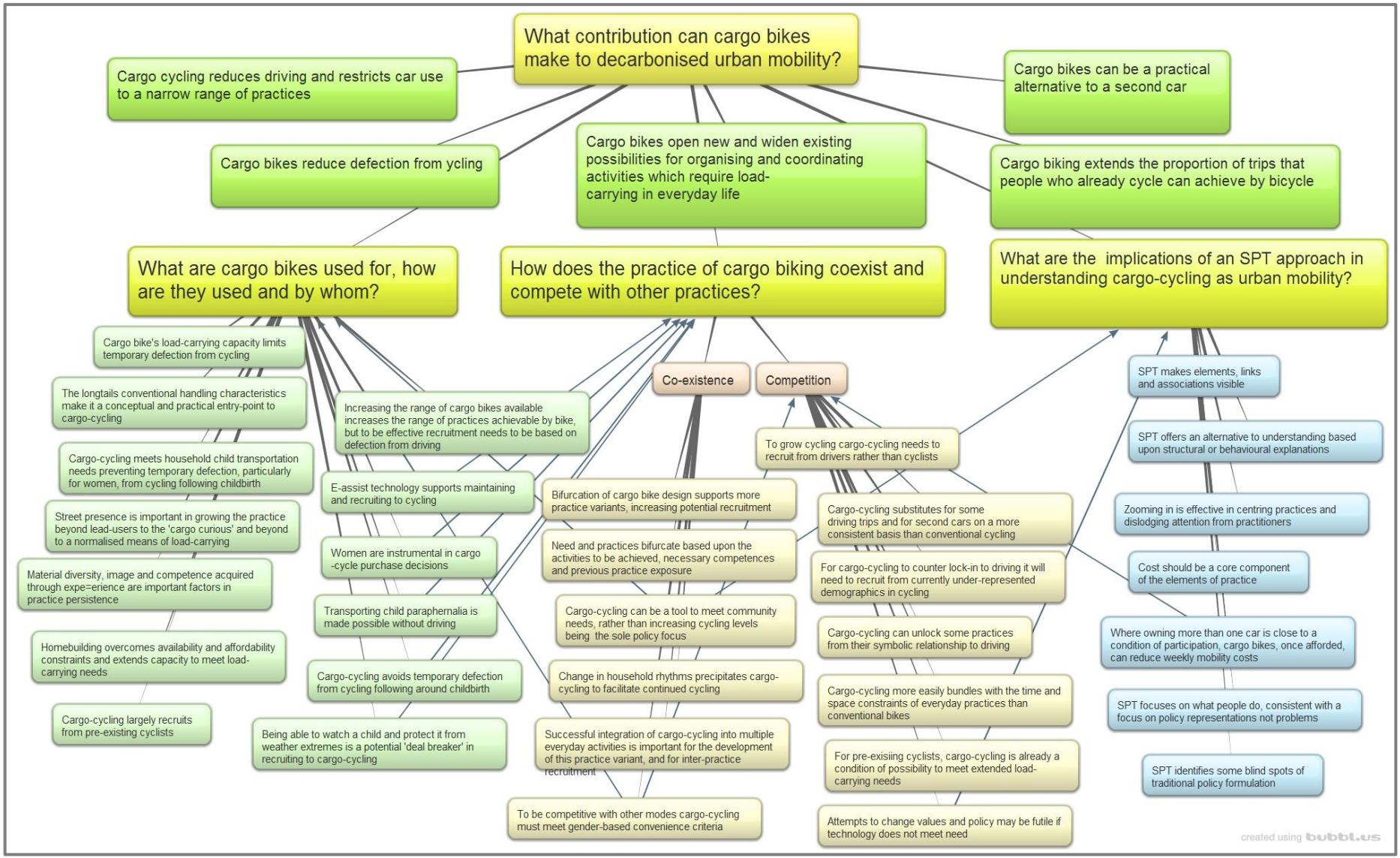


**Figure 11-1 Summary of findings**

The findings can be summarised as three core contributions, which collectively meet the objectives of this research by answering the research question introduced in Chapter 1. I now turn to those objectives, summarising my key arguments. I then reflect upon how these findings have contributed to scholarship on utilitarian cycling. Some limitations of this study are then acknowledged, before identifying potential further avenues of research, and offering some final thoughts on this research topic.

### 11.3.1 How are cargo bikes used, and by whom?

A key focus of this thesis has been the situating of cargo-cycling within wider load-carrying practices, in order to examine how load-carrying is achieved by pedal cycle. A practice theoretical approach demands interrogation of the intersections between practices, and the interrogation of the relationships between individual practice performance and the positioning of that performance within the wider evolving practice entity. As became apparent in Chapters 2 and 3, the extensive literature on cycling has given little attention to load-carrying by pedal cycle, and even less attention to how cargo bikes are used in the urban environment in Western countries. With the exception of recent scholarship by Cox, and the EU funded and European focused CycleLogistics projects (Cox & Rzewnicki, 2015), and some coverage within the commercial logistics literature, cargo-cycling, beyond passing references, has been largely absent from empirical analysis.

The factors identified in Chapter 5, establish a useful frame of reference for the subsequent chapters. Identification of the longtail as a versatile and consensus building affordance for load-carrying is an important contribution of this thesis to retailers, potential practitioners, home-builders, activist, planners, and policymakers. The longtail, including when purchased as an add-on to an existing pedal cycle, or when constructed as a home-build project, offers a number of properties which, at least in part, can overcome constraints on cargo bike incorporation in the load-carrying practices identified in Christchurch and Portland. These properties include, versatility, a smaller footprint than front-loaders and relative ease of storage and use (relevant to practitioners, retailers, and transport planners), familiar handling characteristics in traffic, and relative affordability and inconspicuousness when compared to front-loaders. I, therefore, argue that longtails present both a practical and conceptual entry point to cargo-cycling, as a recognisable manifestation of cycling that can easily blend with the range of

conventional bicycles found within a city. Such characteristics minimalize operational challenges to infrastructure, and comply with the need expressed by some participants, to blend in rather than stand out in lower cycling participation locations.

Conventional two or three wheeled front-loaders afford easier protection of passengers from adverse weather, this factor being presented as a potential 'deal breaker' in wetter climates. However, despite this protection, increased cargo capacity, cargo compartment size, and the stationary stability offered by three wheelers, these designs of cargo bike suffer from images of slowness, and limited versatility in terms of terrain and parking. More recently developed stylish, lightweight and fast front-loaders, popular with cycle couriers, are challenging these images. My observations suggest, that particularly in households with two or more cargo bikes, this design has the potential to become popular for those attracted to the 'sportier' geometry, and able to afford the top of the range price point. E-assist technology is understood to overcome hill-climbing and heavy load carrying constraints. Chapter 5 also shows that E-assist technology, even if not deemed currently necessary, is regarded as an acceptable way of extending cycling through the life-course, as well as facilitating more cycling in time and space than would otherwise be achievable, due to distance, hills, head-winds and time constraints.

Cargo-cycling tends to recruit from pre-existing cyclists rather than non-cyclists. Most cyclists are also drivers, and where cargo-cycling is particularly effective in supporting cycling's modal share, is in reducing the defection from cycling to driving, associated with the development of complex trip-chaining and load-carrying needs. These needs tend to be related to household provisioning and child-care, which continue to be predominantly associated with women's mobility needs. Child raising often precipitates cargo cycle purchase, with women identified as playing a significant role in decisions concerning cargo bike purchase. Cargo bikes are often afforded by selling, or avoiding the purchase of a second car, further limiting driving. Women report well-being benefits associated with being able to combine child-care and other mobility dependent activities with cargo-cycling.

### 11.3.2 How does the practice of cargo-cycling coexist and compete with other practices?

This objective frames consideration of both coexistence and competition in identifying how cargo bikes are incorporated within everyday activities, how they compete with driving as a dominant load-carrying practice, and thus how cargo bikes can contribute to more sustainable decarbonised mobility. Those interviewed and observed for this research conform to recognisable trends in Anglophone countries in terms of age, gender, ethnicity and educational attainment. This is not surprising given the finding that cargo-cyclists tend to be pre-existing cyclists who, due to household circumstances such as the birth of children find their normal utilitarian cycling activities constrained by new household rhythms. For the vanguard of cargo-cycling, achieving utilitarian cycling is already a condition of possibility, with cargo-cycling facilitating substitution of cycling for driving, on a more consistent basis than could be achieved with the use of conventional bicycles. Changes in household rhythm and synchronisation catalyse cargo bike purchase and home-building projects, to facilitate the continued accomplishment of household travel and load-carrying activities by pedal cycle, as a mechanism for meeting extended or more complex suites of needs. Although cargo-cycling is not, in most cases, a total replacement for driving, it does substitute for driving trips, and cargo bikes do substitute for second cars. The successful of integration of the cargo bike into multiple everyday practices is seen to counter the potential tipping point of cycling to driving as household rhythms change.

Increasing availability and recognition of cargo-cycling as a conduit for practice bundling, and as a means of enhancing well-being has the potential to unlock some practices from their symbiotic relationship to driving. Zooming-in on the practice of cargo-cycling in Christchurch and Portland, reveals how cargo-cycling has thus far been meshed with other practices that generate a need for load-carrying. Early cargo–cycling in Christchurch has a strong association with home-building, finding a small but closely interlinked community of home-builders who share equipment and know-how. I demonstrate that, as in Portland, these user innovators are an important facet of the development of cargo-cycling, which overcomes cost constraints and lack of ready local availability of cargo bikes. Resources such as images and internet-based instructions travel to new locations to be incorporated within localised practices, which reflect both household need and local conditions. For practitioners capable of building their own bikes, the cargo bikes appear to

represent a rewarding project and ultimately an affordable way of meeting need. However, in Christchurch, the appeal of home-built-by-others cargo bikes as a cheaper alternative to imported branded cargo bikes seems limited, with lack of a professional finish or other idiosyncrasies being regarded as off-putting, rather than appealing.

A bifurcation of need is established, related to the combination of load-carrying practices to be achieved, the competence requirements of the practice-variant, and previous exposure to sub-practices. Consequently, the bifurcation of cargo-capable designs supports the expansion of the range of achievable practice-variants, thereby extending the potential to promote recruitment to cargo-cycling. However, to grow cycling as a load-carrying practice, recruitment to cargo-cycling needs to directly attract drivers, rather than pre-existing cyclists. Attempts to change values and policy may be futile if technology does not meet need. For cargo-cycling to take hold as a pragmatic mode, capable of countering lock-in to driving, recruitment will be required from under-represented groups including women. The incorporation of E-assist technology may be an important element in avoiding defection from cycling and recruiting non-cyclists to cargo-cycling.

### 11.3.3 Developing a practice theoretical account of cargo-cycling

The final task of this research is to assess the implications of adopting a practice theoretical approach to understand cargo-cycling as urban load-carrying mobility. Practice theory ontology centres analysis on practices, so that doing something is always performing a practice, with epistemological knowledge based upon understanding the relationship between performances and wider society. Consequently, this research has questioned how cargo-cycling practices can decarbonise transportation, by asking which practices people participate in, and how they order and organise practices, to understand the linkages between movement of people and practices. I find that centring practices within a SPT framework can offer important insights into the incorporation of cargo-cycling into urban load-carrying mobility practices. By changing the unit of analysis, from individuals or infrastructure to practices, and by focusing on the elements that make-up cargo-cycling as a recognisable variant of cycling as it is performed in combination with other practices, this research offers a more complete picture of cargo-cycling than approaches which rely on individual attitudes, and other demographic data.

Both cycling and driving are co-located overlapping practices, in the sense that they use similar infrastructure to transport humans and other material things. SPT facilitates the conceptualisation of both the integration of elements in those practices, and the ordering and orchestrating properties of those practices, as bundles of practices congeal in complex temporal rhythms, where routines are practically and emotionally, but not necessarily permanently stuck together (Nicholls & Strengers, 2015: 122). Probing the relationships between marginalised and marginalising practices exposes possibilities for predation, as the congealed complex may not be as uniformly glued as assumed. Bundles and complexes in this scenario, become important, as acquiring previously unconnected practices from the bundle and binding them into a complex, offers a challenge to a normalised way of doing, with new complexes being formed from bundles of pre-existing practices.

Like other applications of practice theory in doctorates, this thesis finds practice theory to be complex and ambiguous, partly due to the number and range of theorists involved in formulations of practice theory. The analytical simplification of SPT is helpful but still subject to theoretical tensions, evident in categorisations of weak and strong applications of SPT. This research, in responding to calls for methodological breadth in practice theory, combines qualitative techniques with an exploratory quantitative study, thus broadening the utility of practice based approaches and accounts (Browne et al., 2013: 13). In making use of the *qualiquantological* affordances of QM to identify statistically significant types of load-carrying, this study identifies with the common focus of multi-participant Q studies on ideal-types, characterised in SPT as recognisable patterns of practice entities, filled out by individual performances (Reckwitz, 2002).

Researchers seeking to explicitly further the scaling of a practice theory approach argue for combining insights from theories of practice and other literatures. Chapter 6 engages with the DIY literatures, in making the unusual step of studying pedal cycles while they are being built, rather than ridden. Chapter 7 conceptualises scale within practice theory based upon Birtchnell's 3 Es and scholarship on indirect activism, through which aspects of the material environment and experience are transformed. Chapter 8 confronts demand for mobility on the basis of practice lock-in to pre-existing configurations of mobility, the constitution of wants and needs, and the extent to which they are negotiable, to advance practice theories identified lack of engagement with issues of social justice and difference. This engagement is

pursued via the car dependence and social exclusion literatures, developing a distinctive account of overcoming forced second car ownership, extending scholarship on non-conformity to normalised mobility practices, and arguing that cargo-cycling can afford transport *advantage* and overcome lock-in to automobile-based mobility practices. In Chapter 9, the relationship between cycling and driving is found to be nuanced rather than categorically distinct, based upon the bifurcation of cycling practices, and the hybridisation of personal transportation, in a form of transmodality, based upon the freight function of travel, and flexibility of demand.

Taking practices as the central unit of enquiry remains unusual, but not rigidly constraining in terms of research techniques and methods employed. Beyond extending the application of SPT to the practice-variant of cargo-cycling, this thesis makes two further contributions to practice theoretical analysis. These are an enhancement to the visualisation of the material, competence, meaning model as a grouping of elements and the extension of that model to incorporate the practice entities and their relationships in time and space. These visual formulations were first introduced in Chapter 4, developed in the empirical chapters and brought together in Chapter 10, to represent the empirical and theoretical coverage of this thesis.

The rethinking of tripartite schematic of the relationship between practice elements as a three core cable, strengthens the representation of the relationship between practice performances and practice entities, with the outer sheathing encapsulating the practice entity as both a pro-forma and a container of performances, but one capable of being altered by additional connections or indeed severed. Further, employing the affordance of a topological diagram to represent the relationships between the practices investigated in this research, progresses visualisation of practice relationships. I, therefore, assert that the enhancements to the visualisations I propose progress the overall visual legibility of SPT. By adopting a zooming technique, based upon a visual schematic, to understand and show relationships and changes in load-carrying practices, this thesis contributes to the empirical articulation of SPT. This understanding is based upon considering practices as whole entities consisting of materials, competences, and meaning, which shape change in mobility practices related to load-carrying, in a processes of rhythmic bifurcation and hybridisation, as practices scale and change. This articulation supports the development of useful empirical analysis, which

operationalises SPT. Focusing on practices as the unit of analysis facilitates understanding of intra- and inter-practice relationships, and possibilities for shaping those trajectories, with load-carrying being inherently connected with processes of mutual co-shaping of objects, cultural values, and embodied activities.

## 11.4 **Limitations**

This thesis set out to explore and understand cargo-cycling as a load-carrying practice, concentrating on the affordances of cargo bikes, in specific locations. This thesis did not try to explore all the manifestations of load-carrying by pedal cycle, to make statistical generalisations, or to ask non-cyclists to speculate on cargo-cycling. Although larger scale quantitative explorations may be important, what is stressed in this thesis, is the ability of small size qualitative studies to make theorised claims about the patterns and dynamics of the material world, an analytical generalisation where results are made more general by becoming valid for categories related to social scientific concepts, due to the theoretical relevance of the sample.

My intention in this research was to purposively identify participants who could talk from life experience about load-carrying by pedal cycle, and specifically cargo-cycling. The participants in this research all use pedal cycles for some forms of load-carrying, from the incidental to the deliberate, and a number have access to cargo bikes. Consequently, they could be expected to show some enthusiasm for cycling, and for achieving some level of load-carrying by pedal cycle. However, to my knowledge, only nine percent of the participants either did not drive or did not own a car. It would, therefore, be reasonable to assume that the participants do not represent a group of cyclists who totally reject car use.

## 11.5 **Further work**

This thesis has furthered understanding of the practical achievement of load-carrying by pedal cycle, and the conceptual and empirical application of practice theory. This research highlights several opportunities for further work.

First there is more work to do on the patterns of inequality evident in the relative (in)ability of individuals to perform practices, which allow them to act sustainably and as “responsible citizens”. Based upon disparities including income and costs, those on low incomes are potentially excluded from performance of some practices, and the consequent direct benefits of the lower running costs of technologies such

as cargo bikes and electric cars, relative to conventional automobiles, and the enhanced cargo capability of cargo bikes relative to conventional bicycles. This thesis has established that cargo-cycling has a number of direct benefits, including enhanced well-being and lower running costs than conventional cars for load-carrying. A further development could be to identify and analyse instances where cargo-cycling has formed part of community cycling schemes based upon ideas of collaborative consumption, community ownership, and resource sharing practices, such as bike libraries. This thesis has provided a foundation for such investigation, recognised in the award of a 2017 two month visiting fellowship by the DEMAND Centre, based at Lancaster University in the UK to investigate such schemes in the UK.

Further, in continuing to experiment with broadening the utility of practice based approaches and accounts, based upon combining theoretical and methodological techniques and analysis, it may be fruitful to consider the potential linkages between the concept of effective speed, lock-in to driving (Walks & Tranter, 2015) and cargo-cycling. This research direction might yield further insights into how a practice theoretical framework, when linked with additional approaches, can extend engagement with questions of social justice, and become more politically engaged.

Additionally, and connected to both the previous points it would be interesting to consider the extent to which countries, and urban areas, with high levels of participation in cycling, which also exhibit noticeable levels of participation in the practice-variant cargo-cycling, formulate transport, land use and climate change policies, consistent with centring practices. Such a reframing could for instance, as advocated by Spurling and McMeekin (2013), look beyond attention to technical fixes and changing attitudes, to shift consumer choices to explore urban mobility practices based upon a reframing around reduced resource intensity, practice substitution and reconfiguring the relationships between practices.

A further line of enquiry relates to E-assist and its role in domestic cycling practices. The empirical evidence from this thesis suggests that E-assist may have multiple roles in encouraging, prolonging cycling both in terms of additional trip length and to increased age, and overcoming topographical and adverse wind conditions, as well as in making cargo-cycling a default practice for load-carrying. Extending

scholarship on E-assist bikes for domestic use would both complement and extend this research.

## 11.6 **Final thoughts**

In the final analysis, load-carrying practices will continue to be achieved via a variety of mechanisms. While online shopping reduces the need for individuals to go to the shops, the goods purchased still have to be conveyed to their destination. As more and more people live in urban areas, the viability of transportation of loads via cargo-cycling increases, whether that practice occurs within the commercial of the domestic realm. Other practices such as taking children to school, leisure activities, and to some degree commuting will in the foreseeable future continue to require physical co-presence and mobility. In the face of greater recent recognition of the impacts of climate change, modes which do not make use of the internal combustion engine are likely to form part of the range of mitigation possibilities. This thesis envisions one particular route to decarbonisation, which not only offers improved sustainability, but also serious fun.

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# Appendix A.Human Ethics Committee approval

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

HUMAN ETHICS COMMITTEE

Secretary, Lynda Griffioen
Email: human-ethics@canterbury.ac.nz

Ref: HEC 2012/07/LR-PS

11 April 2012

Jane Pearce
Department of Geography
UNIVERSITY OF CANTERBURY

Dear Jane

Thank you for forwarding to the Human Ethics Committee a copy of the low risk application you have recently made for your research proposal "Transportation cycling cultures: assessing the importance of load-carrying technologies".

I am pleased to advise that this application has been reviewed and I confirm support of the Department's approval for this project.

With best wishes for your project.

Yours sincerely

Michael Grimshaw
*Chair*
*University of Canterbury Human Ethics Committee*

## Appendix B. Information sheet

College of Science

**Department of Geography**
Tel: +64 3 3667001, Fax: + 64 364 2907

UNIVERSITY OF CANTERBURY
*Te Whare Wānanga o Waitaha*
CHRISTCHURCH NEW ZEALAND

**INFORMATION SHEET**

You are invited to participate in a PhD research project: ***Transportation cycling cultures: assessing the importance of load-carrying technologies.***

*1. What this study is about?*

The goal of this research is to find out what and how people think about using load-carrying bikes for day-to-day transportation purposes. Load-carrying bikes such as cargo and electric bikes have recently become more common in some towns and cities. I am researching how people use load-carrying bikes, for their day-to-day transportation needs, and the views they hold about using such bikes. In many countries women cycle less than men and I am particularly interested in what women think about using these bikes for transportation.

*2. What I will be asking you to do*

I would value your participation in this research. Should you agree, I would like to interview you face-to-face, or by Skype or telephone. The interview will be at a time and place convenient to you. The interview is likely to take up to 90 minutes, and will include you sorting some statements and/or images connected with transportation cycling according to the degree to which you identify with those statements and/or images. With your written permission the interview will be audio taped. Should there be any follow-up to this interview your further consent will be sought.

*3. Your rights as a participant in this research*

The results of this research may be published. I am seeking your participation on a voluntary basis and you have the right to decline to take part. Information you supply will be kept confidential to the researcher, and you will not be identified in any publications that may result from this research. If you decide to participate, you may at any time during your participation:

- Decline to answer any particular question;
- Withdraw from the research;
- Ask any questions about the research;
- Request that specific information you have provided not be used in the context of the research;
- Ask for the audio tape to be turned off at any time during the interview.

This project is being carried out as part of Doctoral research by Jane Pearce under the supervision of Professor Simon Kingham who can be contacted at +64 3 3642987 ext. 7936. He will be pleased to discuss any concerns you may have about participation in this research.

This project has been reviewed ***and approved*** by the Geography Department and the University of Canterbury Human Ethics Committee Low Risk Approval process.

# Appendix C. Information sheet II

College of Science

Department of Geography
Tel: +64 3 3667001, Fax: + 64 364 2907

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

**INFORMATION SHEET**

You are invited to participate in a PhD research project: ***Transportation cycling cultures: assessing the importance of load-carrying technologies – building, selling and using cargo bikes.***

*1. What this study is about?*

The goal of this research is to find out what and how people think about using load-carrying bikes for day-to-day transportation purposes. Load-carrying bikes such as cargo and electric bikes have recently become more common in some towns and cities. In this phase of the study I am researching how and why people use cargo bikes for their personal and business transportation needs, and the views they hold about the use of cargo bikes.

*2. What I will be asking you to do*

I would value your participation in this research. Should you agree, I would like to interview you face-to-face, or by Skype or telephone. The interview will be at a time and place convenient to you. Each interview is likely to take between 60 and 90 minutes, and will include a discussion of your experience of cargo bikes. With your written permission the interview will be audio taped. Should there be any follow-up to this interview your further consent will be sought.

*3. Your rights as a participant in this research*

The results of this research may be published. I am seeking your participation on a voluntary basis and you have the right to decline to take part. Information you supply will be kept confidential to the researcher, and you will not be identified in any publications that may result from this research. You will be offered the opportunity to review and correct the transcripts of your interview. If you decide to participate, you may at any time during your participation:

- Decline to answer any particular question;
- Withdraw from the research;
- Ask any questions about the research;
- Request that specific information you have provided not be used in the context of the research;
- Ask for the audio tape to be turned off at any time during the interview.

This project is being carried out as part of Doctoral research by Jane Pearce under the supervision of Professor Simon Kingham who can be contacted at +64 3 3642987 ext. 7936. He will be pleased to discuss any concerns you may have about participation in this research.

This project has been reviewed *and approved* by the Geography Department and the University of Canterbury Human Ethics Committee Low Risk Approval process.

## Appendix D. Consent form

**College of Science**

**Department of Geography**
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UNIVERSITY OF CANTERBURY
*Te Whare Wānanga o Waitaha*
CHRISTCHURCH NEW ZEALAND

Jane Pearce
Department of Geography
University of Canterbury
Private Bag 4800
Christchurch 8140
New Zealand

**CONSENT FORM**

***Transportation cycling cultures: assessing the importance of load-carrying technologies – building, selling and using cargo bikes.***

I have read and understood the description of the above-named research. On this basis I agree to participate as a subject in this research, and I consent to publication of the results of the research with the understanding that confidentiality will be preserved.

I understand also that I may at any time withdraw from the research, including withdrawal of any information I have provided.

I note that the project has been reviewed ***and approved*** by the Geography Department and the University of Canterbury Human Ethics Committee Low Risk Approval process.

NAME (please print):

Signature:

Date:

## Appendix E. Q sort instructions

Transportation Cycling Cultures: Assessing the Importance of Load-Carrying Technologies

Looking at Load-Carrying Bikes – Instruction Sheet for Q Sort

Contents:

- 1 Instruction Sheet
- 2 Response Forms (one to return to Jane and one to keep for your own records).
- 1 Consent Form
- 9 *number* cards in a zip-lock bag
- 34 *picture* cards in a zip-lock bag
- 1 postage paid return envelope

Preparation:

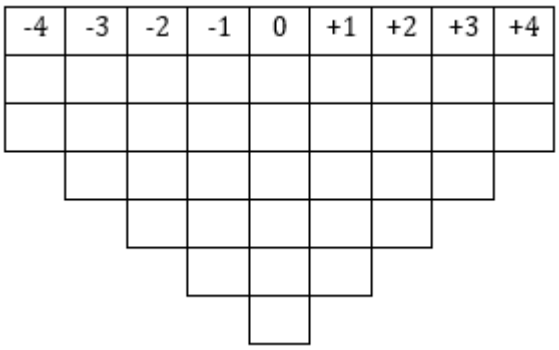
1. Review the information sheet sent to you when you were invited to take part in this study & included on page 4 of this pack. If you have questions, please ask Jane – jane.pearce@pg.canterbury.ac.nz
2. Transportation needs for the purposes of this study means your daily requirement to transport yourself, the goods you purchase or collect during the course of your day and your dependents.

Instructions for sorting:

**1.** Clear some space on a large table or the floor to set up the sorting grid. Arrange the number 9 *number* cards toward the back of the table or floor space in a line from -4 to +4 so that it looks like this:

| -4 | -3 | -2 | -1 | 0 | +1 | +2 | +3 | +4 |
|---|---|---|---|---|---|---|---|---|

2. You are asked to provide an assessment, from your own point of view, of the type of bike that would, if you had little or no access to a car be *the ideal load-carrying bike to meet your transportation needs* by sorting the 34 pictures against the -4 to +4 scale, with the specified number of *picture* cards under each *number* card so that it eventually looks like this:




The scale represents a continuum from (at the +4 end): 'An ideal load-carrying bike **would** be like [the picture]' to (at the -4 end): 'An ideal load-carrying bike **would not** be like the [the picture]'. On the scale 0 is the crossover point and can be interpreted as a neutral point between would and would not. It can also be interpreted as something like 'possibly' or 'it depends'.

3. It is suggested that you first look at all the *picture* cards and sort them into 3 rough piles:
   - Those towards the **would** (+4) end of the scale;
   - Those towards the **would not** (-4) end of the scale; and
   - Those in between.

Do not worry if, at this stage, your three piles are unequal in size.

4. You can then work your way through your piles. Start with the **would** pile, and choose the 2 *picture* cards which would be your ideal load-carrying bike. Place these under the +4 *number* card (the order in which you place the *picture* cards under the *number* cards is not relevant). Next look through your **would not** pile and choose the 2 *picture* cards that would not be your ideal load-carrying bike. Place these under the -4 *number* card. Continue in this way, alternating between the rough piles placing 3 *picture* cards under both the +3 and -3 *number* cards and so on moving from strong, to moderate to mild views about your ideal load-carrying bike. You will have 6 *picture* cards left to place under the middle 0 *number* card.
5. Now look over the whole arrangement to see if you want to move any *picture* cards between the *number* card columns and make sure that you have the required number of *picture* cards in each *number* card column.

Reporting your results

1. Fill in the Response Form by writing in the *picture* card numbers from your sort into table provided. ***Please double check to avoid recording errors***.
2. Before you collect up the cards you are invited to answer the questions below the table on the response form.
3. **Choose and record a 4 digit personal identification number (PIN) on the Response Form**. Make a note of this PIN if you wish to be able to identify your response in the reporting of the data analysis.
4. Return the following in the postage paid envelope to Jane:

☐ 1 completed response form (the second form is for your own records)

☐ 34 *picture* cards

☐ 9 *number* cards

Jane Pearce
Department of Geography
University of Canterbury
Private Bag 4800
Christchurch 8140
New Zealand

THANK YOU

## Appendix F. Interview protocol

**Interview protocol**

The interviews will be semi-structured in order to respond to the knowledge and experience of the participants. Questions that will be asked to open-up discussion with participants will be taken from this list:

1. What got you interested in cargo bikes?
2. How long have you used a cargo bike?
3. What cargo bikes do you have experience of using?
4. For what purposes do you use cargo bikes?
    a. What is your experience of using cargo bikes for personal transportation?
    b. What is your experience of using cargo bikes for business transportation?
5. What made you choose to use/build/sell this/these brands/models of cargo bike(s)?
6. What other modes of transportation do you use?
7. What other modes of transportation do people in your household use?
8. What experience do you have of building cargo bikes?
9. How does your local cycling infrastructure, such as bike lanes and parking impact on your use of cargo bikes?
10. How do other road users react to your use of cargo bikes?
11. What are your future intentions/aspirations for the use of cargo bikes?
12. What are the main things that have contributed to cargo bike use in your city?
13. Why do you sell cargo bikes?
14. Why do you build cargo bikes?
15. Who are cargo bikes useful for?
16. What for you are key features of a cargo bike?
17. Is electric assist necessary & why?
18. Why is a cargo bike better for your business than another form of transportation?
19. Who buys cargo bikes?
20. What draws new people to using cargo bikes?